Low voltage electrical distribution

ULP System

ULP (Universal Logic Plug)
connection system

User manual
04/2011

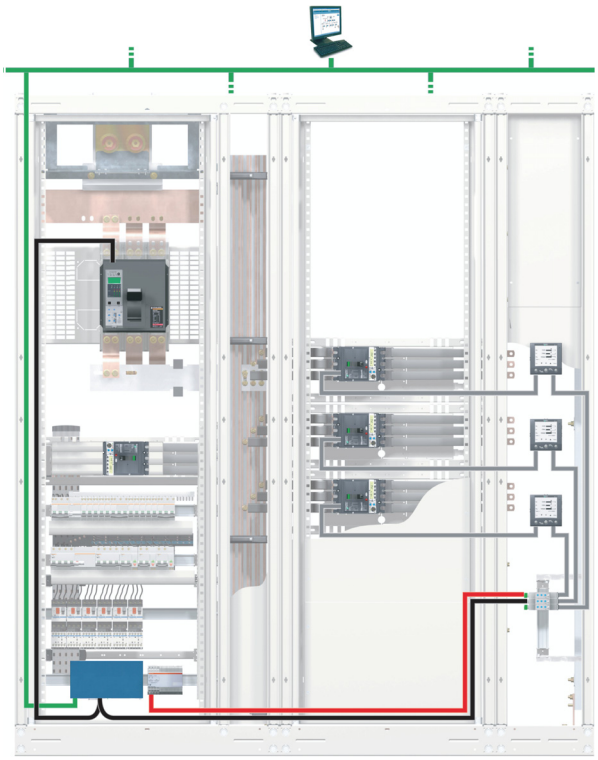

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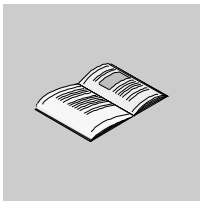
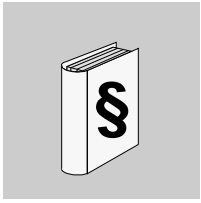
Table of Contents



	Safety Information	**5**
	About the Book	**7**
Chapter 1	**The ULP System**	**9**
	The ULP System	10
	ULP System Modules and Accessories	12
	Connecting the Compact NSX Circuit Breaker to the ULP System	14
	Application	17
Chapter 2	**ULP System Architectures**	**25**
2.1	ULP Connection and Power Supply Rules	26
	Composition Rules for Intelligent Modular Units (IMUs)	27
	Intelligent Modular Unit (IMU) with Draw-out Unit	30
	ULP System Power Supply	32
2.2	Rules for Connection to the Modbus Network	34
	Connection of Modbus Communication Interface Modules	35
	Connection to the Modbus Master	38
2.3	ULP System Architectures	41
	Presentation of the ULP System Architectures	42
	Standalone Architecture	43
	Centralized Modbus Architecture	44
	Daisy-Chained Distributed Modbus Architecture	51
	Tap-Linked Distributed Modbus Architecture	57
Chapter 3	**ULP System Modules**	**67**
3.1	Modbus Communication Interface Module	68
	Presentation of the Modbus Communication Interface Module	69
	Installing the Modbus Communication Interface Module	71
	Operation of the Modbus Communication Interface Module	73
	2-wire RS 485 isolated repeater Module	76
3.2	Front Display Module FDM121	81
	Presentation of the Front Display Module FDM121	82
	Installing the Front Display Module FDM121	83
	Operation of the Front Display Module FDM121	89
	Main Menu	92
	Quick View Menu	93
	Metering Menu	95
	Control Menu	97
	Alarms Menu	99
	Services Menu	102
3.3	Maintenance Module	107
	Presentation of the Maintenance Module	108
	Mounting the Maintenance Module	111
	Connection to the Test Port on the Micrologic Trip Unit	112
	Maintenance Module ULP Connection	113
	Using the Maintenance Module Connected to the Test Port on the Micrologic Trip Unit	115
	Using the Maintenance Module Connected to the ULP System	118
	Use - Summary	120
3.4	RSU Software	121
	Presentation of the RSU Software	122
	RSU and Intelligent Modular Unit (IMU)	125
Appendices		**129**
Appendix A	**ULP System Appendices**	**131**
	Technical Characteristics of ULP Modules	132
	ULP Cable Characteristics	134
	Modbus Cable Characteristics	135
	ULP System Part Numbers	137

Safety Information



Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** equipment damage.

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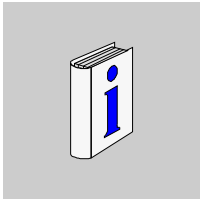
A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and the installation, and has received safety training to recognize and avoid the hazards involved.

About the Book



At a Glance

Document Scope

The aim of this manual is to provide installers and maintenance personnel with the information needed to set up and operate the ULP (Universal Logic Plug) system.

Validity Note

This document is applicable to ULP system modules and accessories associated with Compact NSX 100 to 630 A circuit breakers.

Related Documents

Title of Documentation	Reference Number
Compact NSX circuit breakers - User manual	LV434100
Micrologic 5 and 6 trip units - User manual	LV434103
Modbus Compact NSX - User manual	LV434106
Compact NSX 100-630 A - Catalogue	LVPED208001EN
Training manual - Electromagnetic compatibility	DEG999

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The ULP System

1

Aim of this Chapter

This chapter describes the ULP (Universal Logic Plug) system for Compact NSX circuit breakers.

What's in this Chapter?

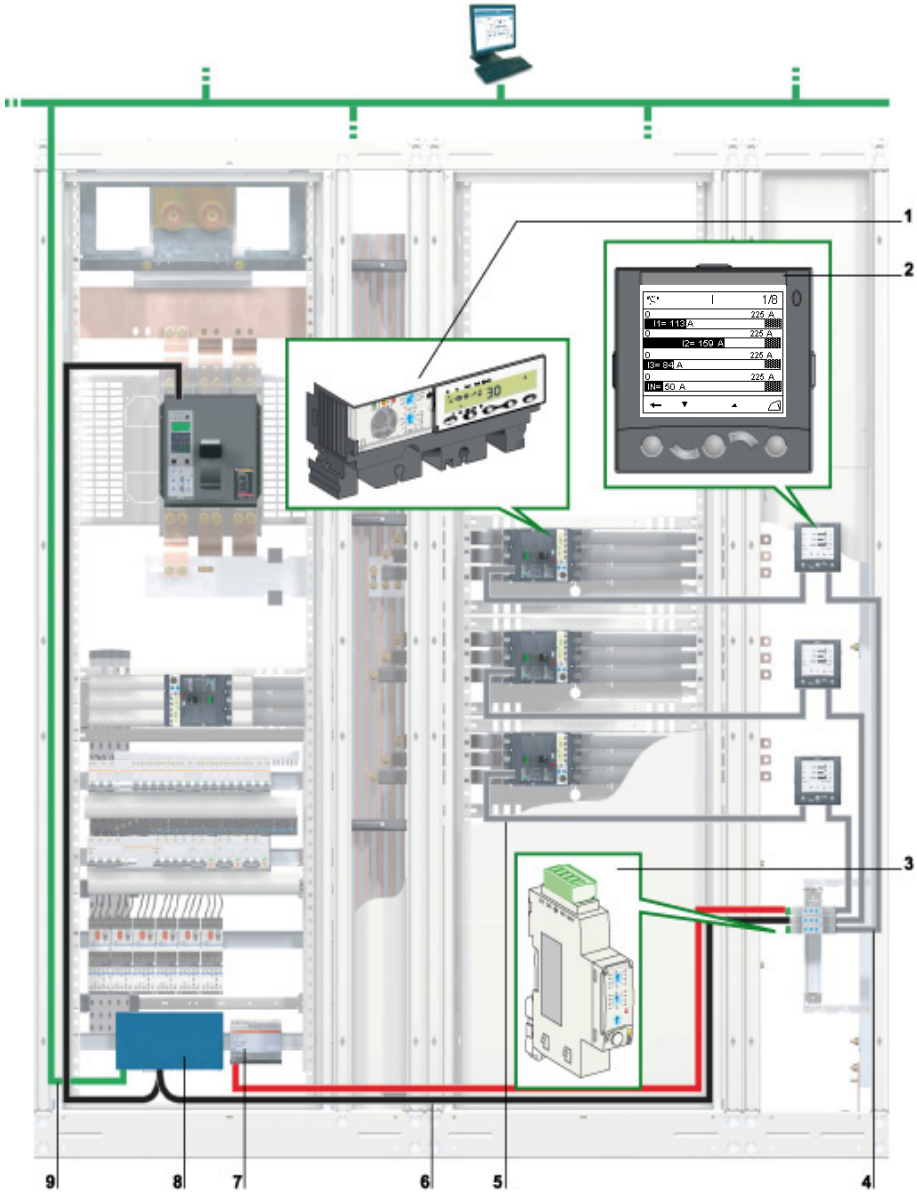
This chapter contains the following topics:

Topic	Page
The ULP System	10
ULP System Modules and Accessories	12
Connecting the Compact NSX Circuit Breaker to the ULP System	14
Application	17

The ULP System

Definition

The ULP (Universal Logic Plug) system is a connection system which can be used to construct an electrical distribution solution integrating metering, communication and operating assistance functions for the Compact NSX circuit breaker.



1 Micrologic 5 or 6 trip unit
2 Front display module FDM121
3 Modbus communication interface module
4 ULP cord
5 NSX cord
6 Modbus network
7 24 VDC auxiliary power supply
8 Communication gateway (EGX or MPS100)
9 Ethernet network

The ULP system can be used to enhance the Compact NSX circuit breaker functions by:

- Local display of measurements and operating assistance data with the front display module FDM121
- A Modbus communication link for access and remote monitoring with the Modbus communication interface module
- Test, setup and maintenance functions with the maintenance module and the LTU and RSU software

Thanks to the ULP system, the Compact NSX circuit breaker becomes a metering and supervision tool to assist energy efficiency and can be used to:

- Optimize energy consumption by zone or by application, according to the load peaks or priority zones
- Manage the electrical equipment better

For more information on the ULP system and the FDM121 display module, refer to the *ULP system - User manual*.

Intelligent Functional Unit

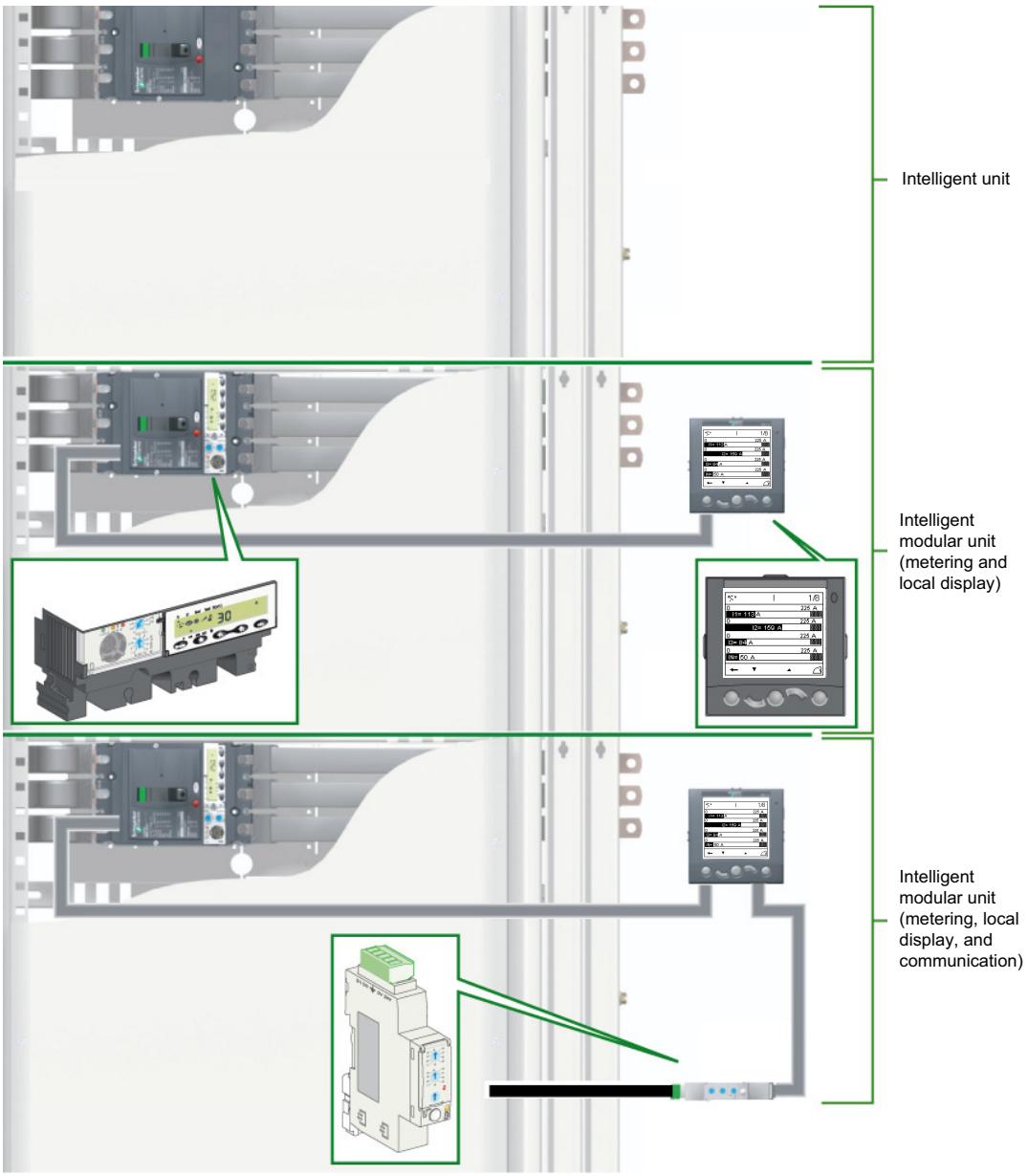
A functional unit is a mechanical and electrical assembly containing one or more products to perform a function in a switchboard (incoming protection, motor command and control). The functional units are modular and are easily installed in the switchboard.

Built around each Compact NSX circuit breaker, the functional unit consists of:

- A dedicated plate for installing the Compact NSX circuit breaker
- An escutcheon on the front face to avoid direct access to live parts
- Prefabricated links to the busbars
- Devices for creating the connection on site and running the auxiliary wiring through

The ULP system can be used to enhance the functional unit with a front display module FDM121 for a display of all the measurements and operating assistance data supplied by the Micrologic 5 or 6 trip units and/or a Modbus communication interface module for a link to a Modbus network.

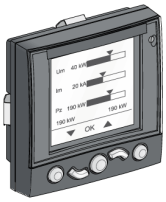
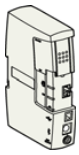
Thanks to the ULP system, the functional unit becomes intelligent since it includes metering functions and/or communication functions.


Intelligent unit
Intelligent modular unit (metering and local display)
Intelligent modular unit (metering, local display, and communication)

ULP System Modules and Accessories

ULP Modules

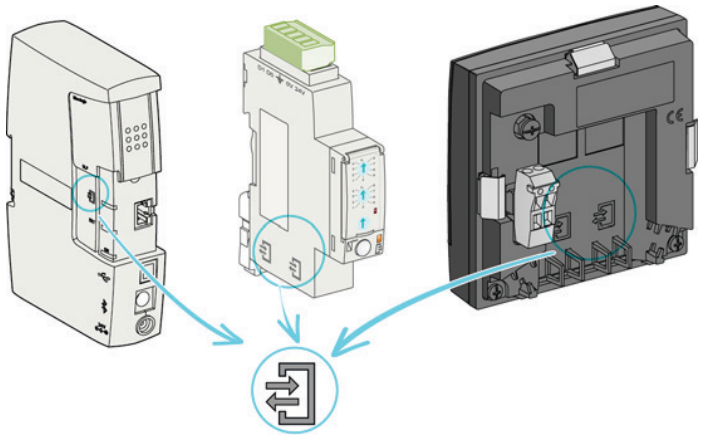
The ULP modules are described below:

ULP Module	Description	Part Number
Modbus communication interface module	The Modbus communication interface module is a communication interface which allows intelligent modular units (IMUs) in the ULP system to communicate using the Modbus protocol. The Modbus communication interface module is described in *Modbus Communication Interface Module, page 68*. **NOTE:** The 2-wire RS 485 isolated repeater module (part number TRV00211) electrically isolates a 2-wire Modbus RS 485 network inside the switchboard from a 2-wire RS 485 Modbus network outside the switchboard. This module is described in *2-wire RS 485 isolated repeater Module, page 76*.	TRV00210
Front display module FDM121 	The front display module FDM121 is a local display unit dedicated to displaying measurements and operating assistance data from the IMU. The front display module FDM121 is described in *Front Display Module FDM121, page 81*.	TRV00121
Maintenance module 	The maintenance module is dedicated to testing, set-up and maintenance of the IMU modules, using the RSU and LTU software. The maintenance module is described in *Maintenance Module, page 107*.	TRV00911
	RSU software	LV4ST100
	LTU software	LV4ST121

ULP RJ45 Connector

ULP modules have RJ45 connectors which are identified by the pictogram .

As a general rule, each ULP module has two identical RJ45 connectors in parallel, which can be used to connect the IMU ULP modules in a daisy chain, in any order, using ULP cables.



Updating the Firmware in ULP Modules

The user can update the ULP module firmware.

The ULP module firmware is updated using the RSU software. For more information, refer to the *RSU Online Help*.

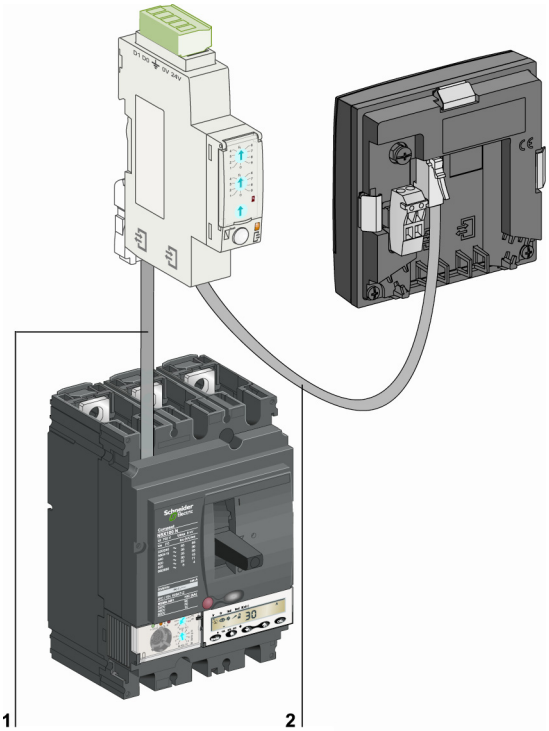
When updating the firmware, a **Readme.txt** file provides information on the latest functions.

ULP Cable

ULP cables are used to interconnect ULP modules within a single IMU. They have male RJ45 connectors at both ends and are available in several lengths.

	Description	Part Number
	L = 0.3 m (10 cables)	TRV00803
	L = 0.6 m (10 cables)	TRV00806
	L = 1 m (5 cables)	TRV00810
	L = 2 m (5 cables)	TRV00820
	L = 3 m (5 cables)	TRV00830
	L = 5 m (1 cable)	TRV00850

ULP modules are interconnected by simple plug and play connection using ULP cables, without prior parameter setting.

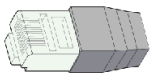


1 NSX cord
2 ULP cables

ULP terminator

The line terminator closes the unused ULP connector on a ULP module.

It consists of an RJ45 connector and has passive components in a sealed unit linked to this connector.

	Description	Part Number
	10 ULP terminators	TRV00880

RJ45 Female/Female Connector

The RJ45 female/female connector is used to connect two ULP cables end-to-end and thus extend them.

It consists of two female RJ45 connectors linked by a direct electrical connection.

	Description	Part Number
	10 RJ45 female/female connectors	TRV00870

For an example of use of the RJ45 female/female connector, see *Drill Hole Mounting, page 85*.

Connecting the Compact NSX Circuit Breaker to the ULP System

Introduction

The Compact NSX circuit breaker connects to the ULP system by means of the NSX cord. The Compact NSX circuit breaker must be equipped with a BSCM and/or a Micrologic 5 or 6 trip unit.

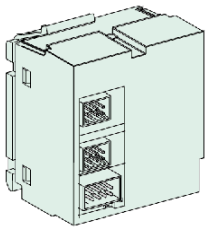
Micrologic 5 and 6 Trip Units

Micrologic trip units 5 and 6 are designed to provide multiple functions:

- Protecting the electrical distribution system or specific applications
- Metering instantaneous values, metering demand values for electrical quantities
- Kilowatt hour metering
- Operating assistance (peak demand, customized alarms, operation counter, etc.)
- Communication

For more information on the Micrologic 5 and 6 trip units, refer to the *Micrologic 5 and 6 trip units - User manual*.

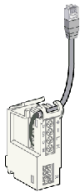
BSCM

	Description	Part Number
	The BSCM (Breaker Status and Control Module) performs the: ● Status indication functions for the Compact NSX circuit breaker ● Control of the communicating motor mechanism ● Operating assistance functions The BSCM can be used with thermal-magnetic and Micrologic electronic trip units. For more information on the BSCM, refer to *Compact NSX circuit breakers - User manual*.	LV434205

NSX Cord

The NSX cord is an internal connection block that connects the Compact NSX circuit breaker equipped with the BSCM and/or the Micrologic 5 or 6 trip unit to a ULP module by means of its RJ45 connector.

The NSX cord is suited to applications < 480 VAC, and it is available in 3 lengths and terminated with a male RJ45 connector for direct connection to a ULP module.

	Description	Part Number
	L = 0.35 m	LV434200
	L = 1.3 m	LV434201
	L = 3 m	LV434202

For more information on the NSX cord, refer to *Compact NSX circuit breakers - User manual*.

Isolated NSX Cord

For applications > 480 VAC, an isolated variant of the NSX cord needs to be used, terminated by an electronic module with a female RJ45 connector. A ULP¨cord must be used to connect the isolated NSX cord electronic module to a ULP module.

The reference for the isolated NSX Cord is LV434204.

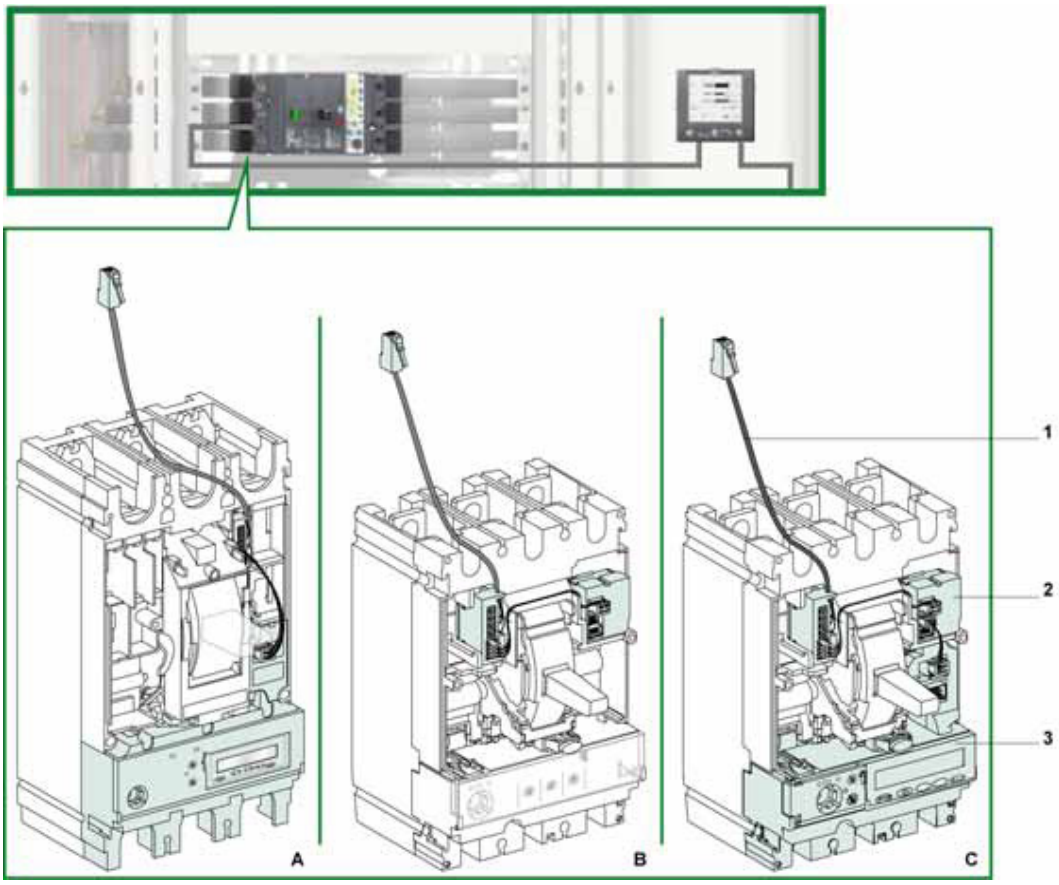
The isolated NSX cord electronic module must be supplied with 24 VDC in order to guarantee isolation of the ULP system.

The table below summarizes the electronic module characteristics:

Characteristic	Value
Dimensions	27 x 27 x 27 mm
Mounting	On DIN rail
Degree of protection of the installed module	• On the front panel (wall-mounted enclosure): IP40 • On the connections (behind the enclosure door): IP20
Operating temperature	-25...+70°C
Power supply voltage	24 VDC -20%/+10% (19.2...26.4 VDC)
Consumption	• Typical: 20 mA/24 VDC at 20°C • Maximum: 30 mA/19.2 VDC at 60°C

Connection to the ULP System with NSX Cord

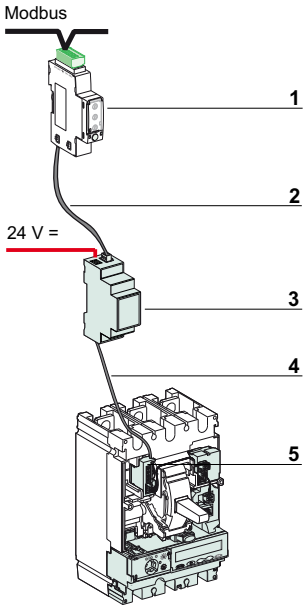
The figure below shows connection of the Compact NSX circuit breaker to the intelligent modular unit (IMU) by means of the NSX cord:



1 NSX cord
2 BSCM (Breaker Status and Control Module)
3 Micrologic 5 or 6 trip unit
A NSX cord and Micrologic trip unit
B NSX cord and BSCM
C NSX cord, BSCM and Micrologic 5 or 6 trip unit

Connection to the ULP System with Isolated NSX Cord

The figure below shows connection of the Compact NSX circuit breaker to the intelligent modular unit (IMU) by means of the isolated NSX cord:



1 Modbus communication interface module
2 ULP cable
3 Electronic module, with female RJ45 connector
4 1.3 m cord
5 Compact NSX internal connector

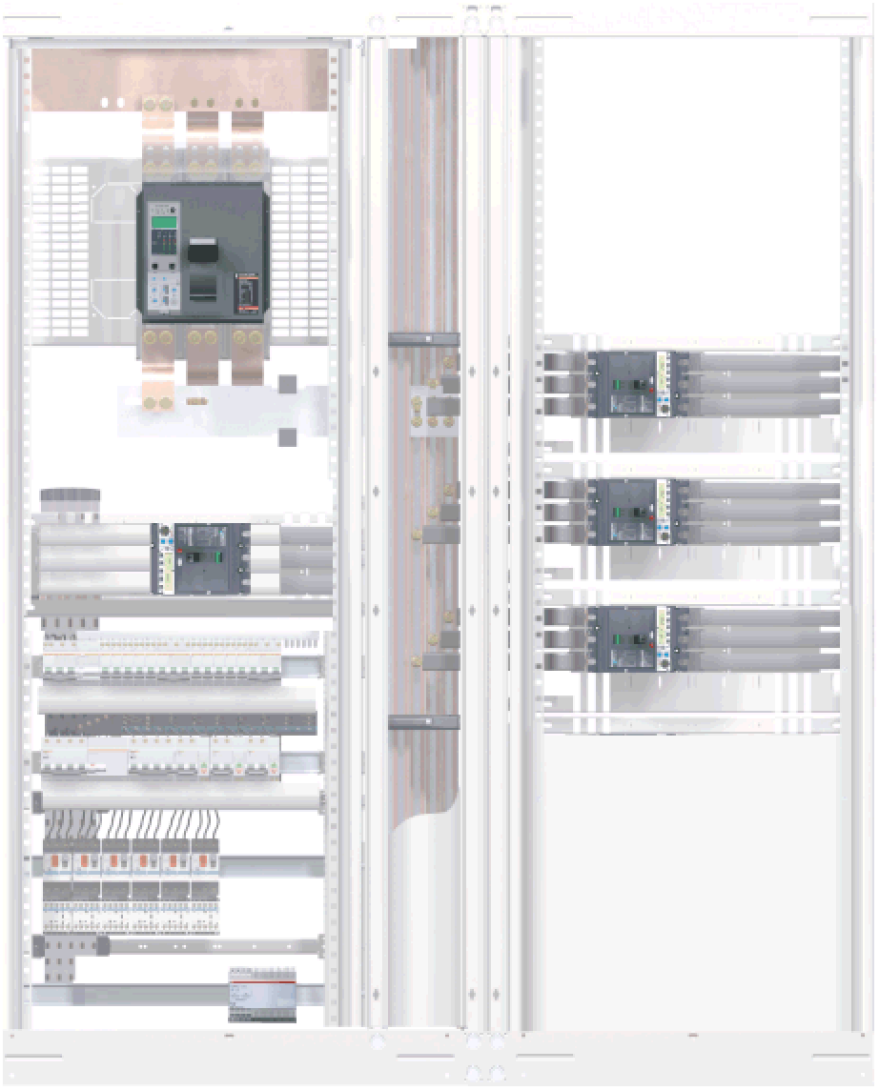
Application

Introduction

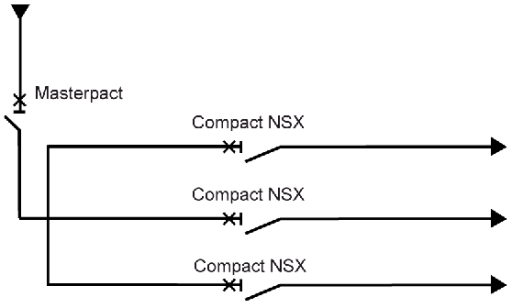
The example below shows a switchboard consisting of Compact NSX modular units enhanced by the addition of metering, display, and Modbus communication functions.

Compact NSX Modular Units

The figure below shows a switchboard with Compact NSX modular units:

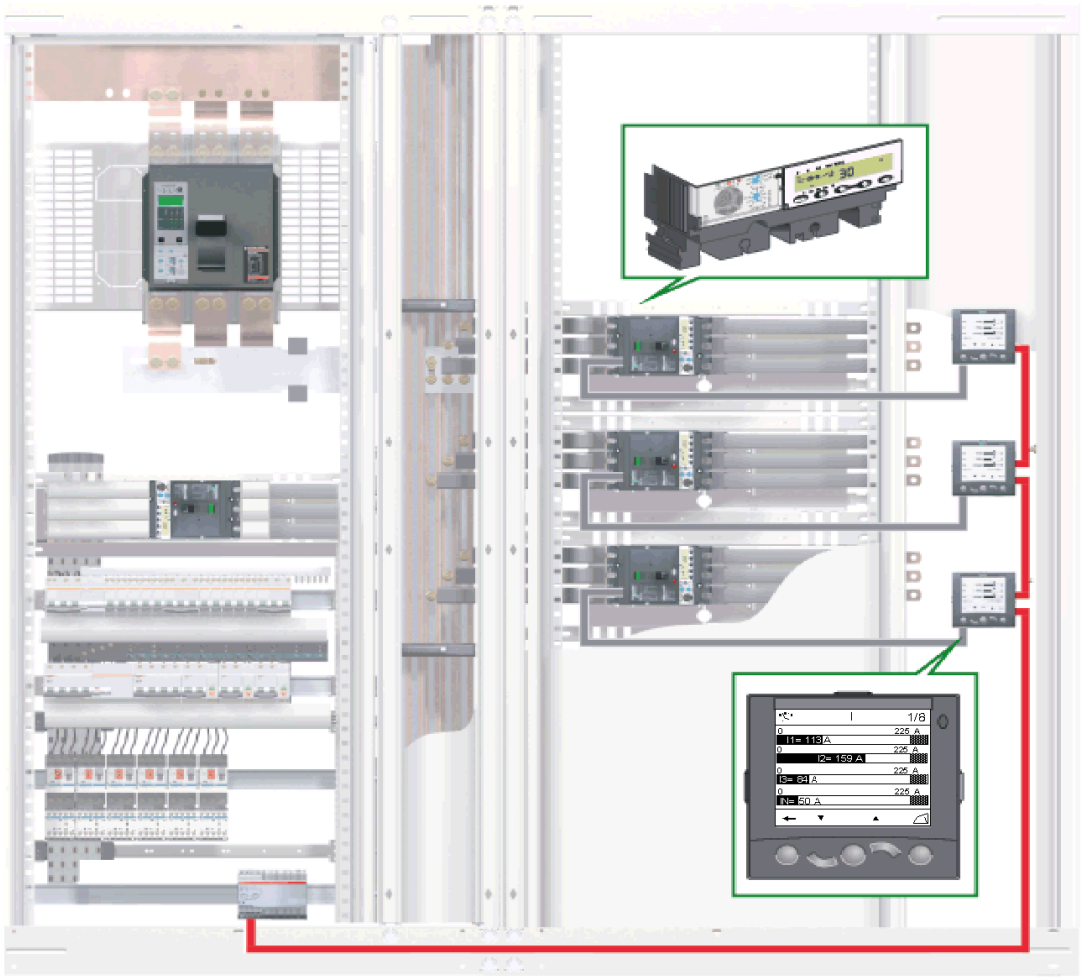


The figure below shows the corresponding wiring diagram:



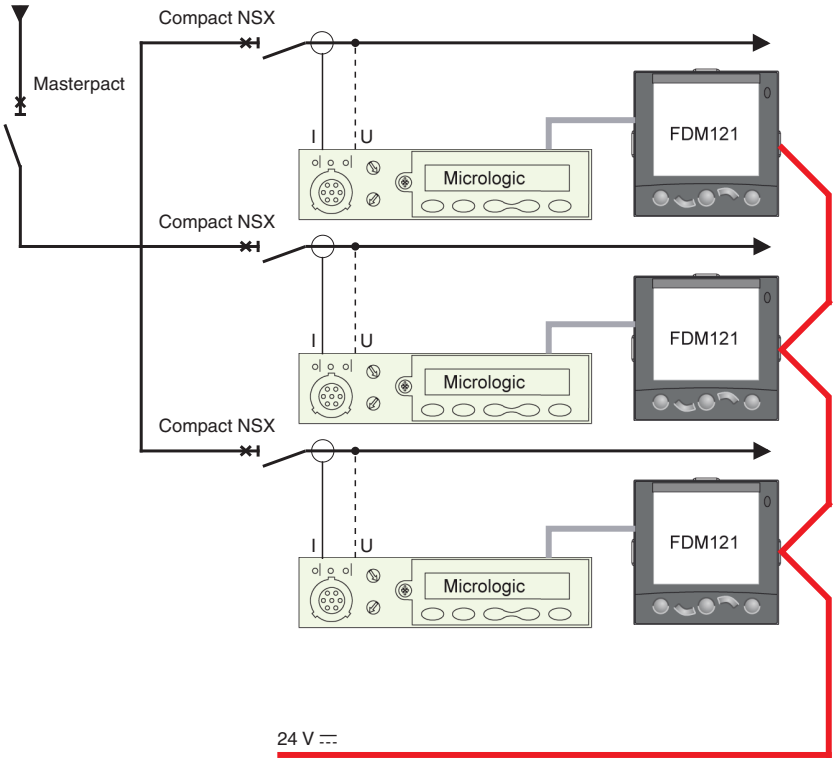
Addition of the Metering and Display Functions

In order to incorporate metering functions, the Compact NSX circuit breaker is equipped with a Micrologic 5 or 6 trip unit. The Micrologic trip unit provides the metering values on its local display and on the front display module FDM121:



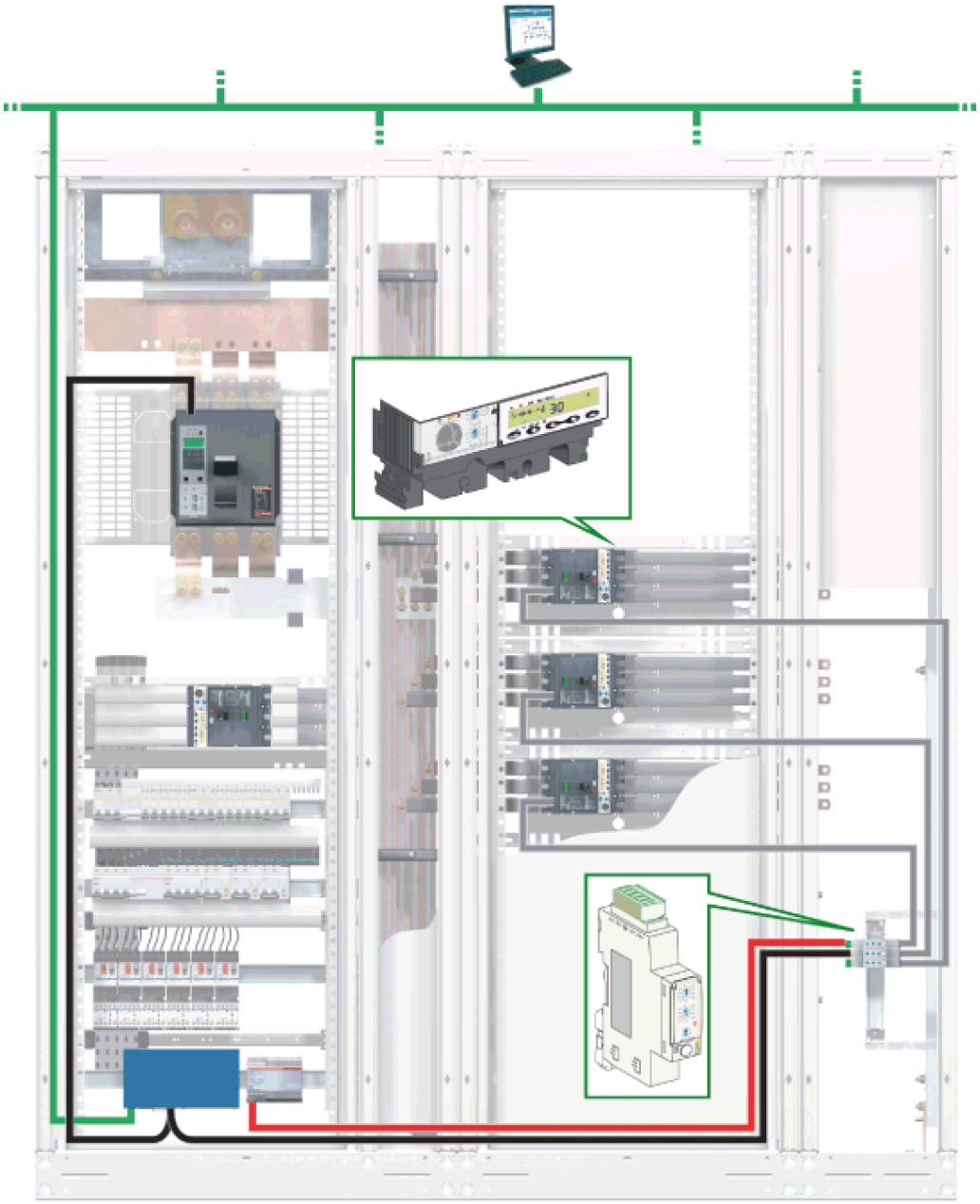
This gives the IMUs all the Power Meter data as well as assistance with operation of the Compact NSX circuit breaker (alarms associated with metering values, histories and tables of time-tagged events, maintenance indicators).

The figure below shows the corresponding wiring diagram:

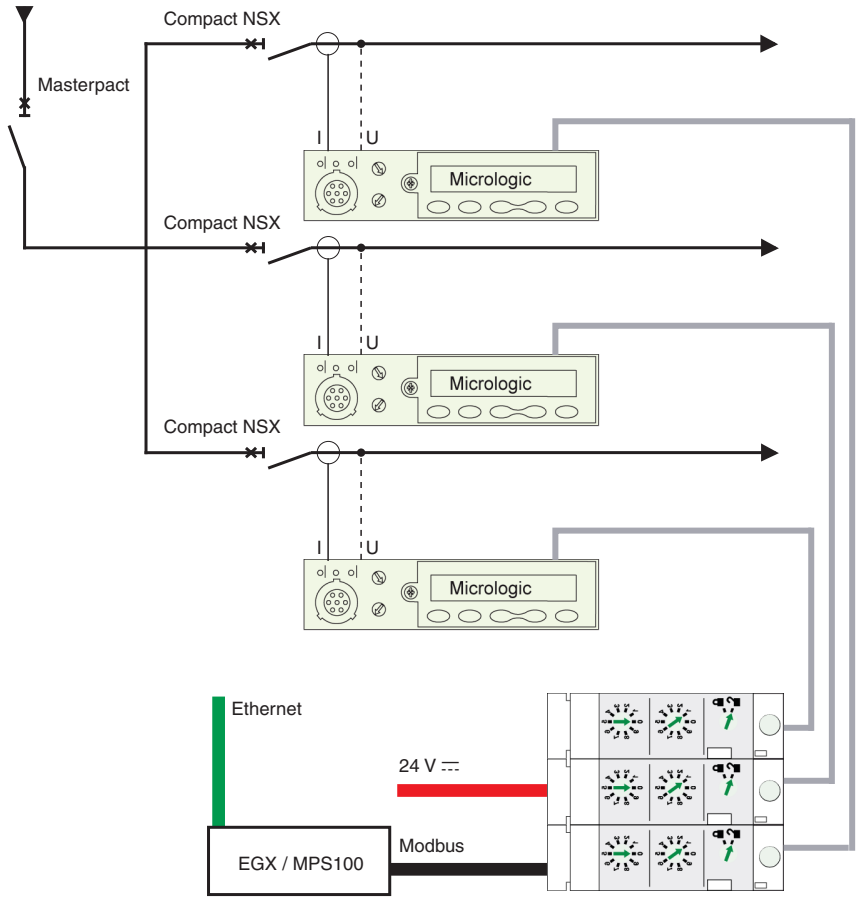


Addition of the Modbus Communication Function

The IMUs can be connected to a Modbus communication network by means of the Modbus communication interface module. An EGX or MPS100 gateway is used for connection to the Ethernet network:



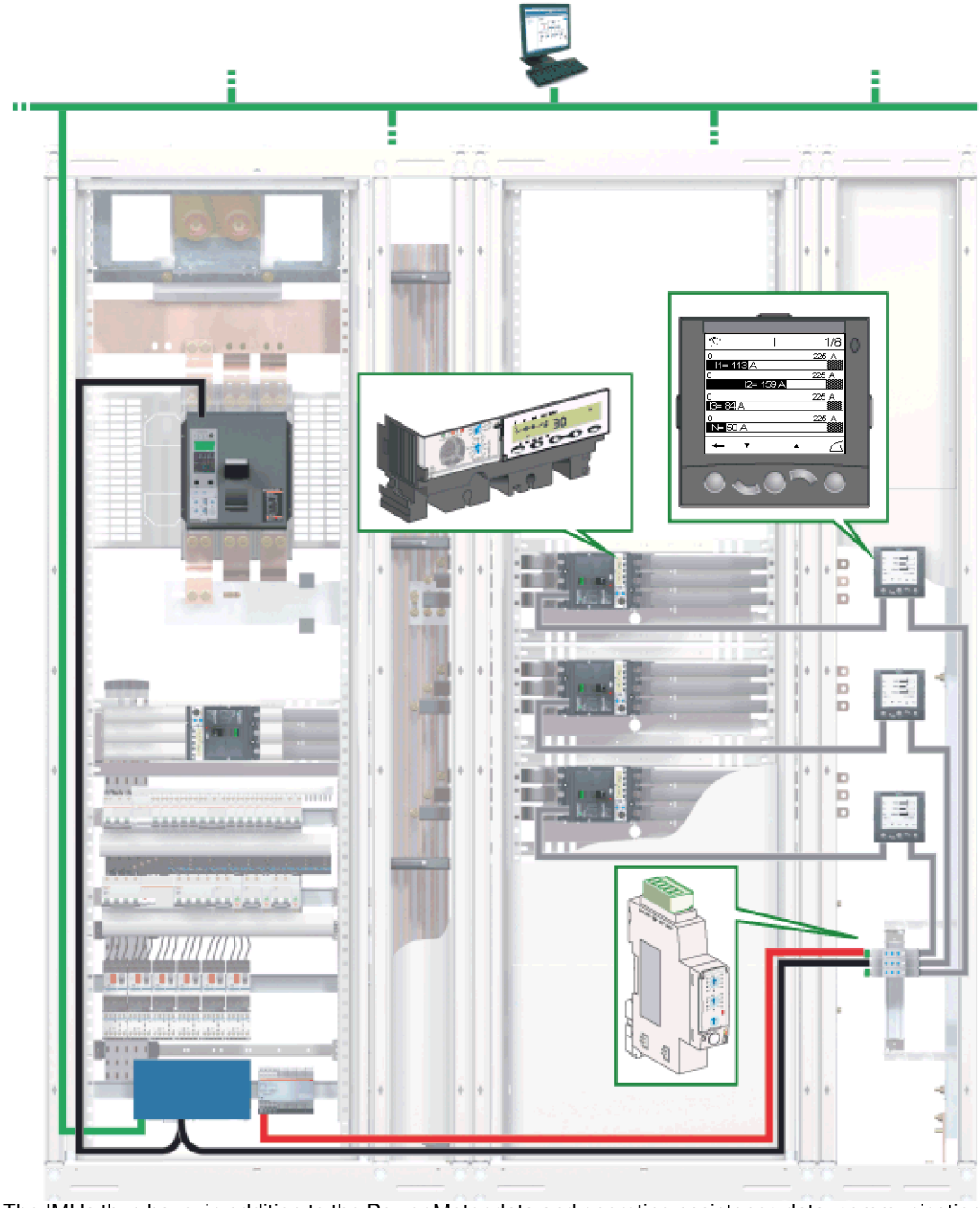
The figure below shows the corresponding wiring diagram:



Addition of the Metering, Display, and Modbus Communication Functions

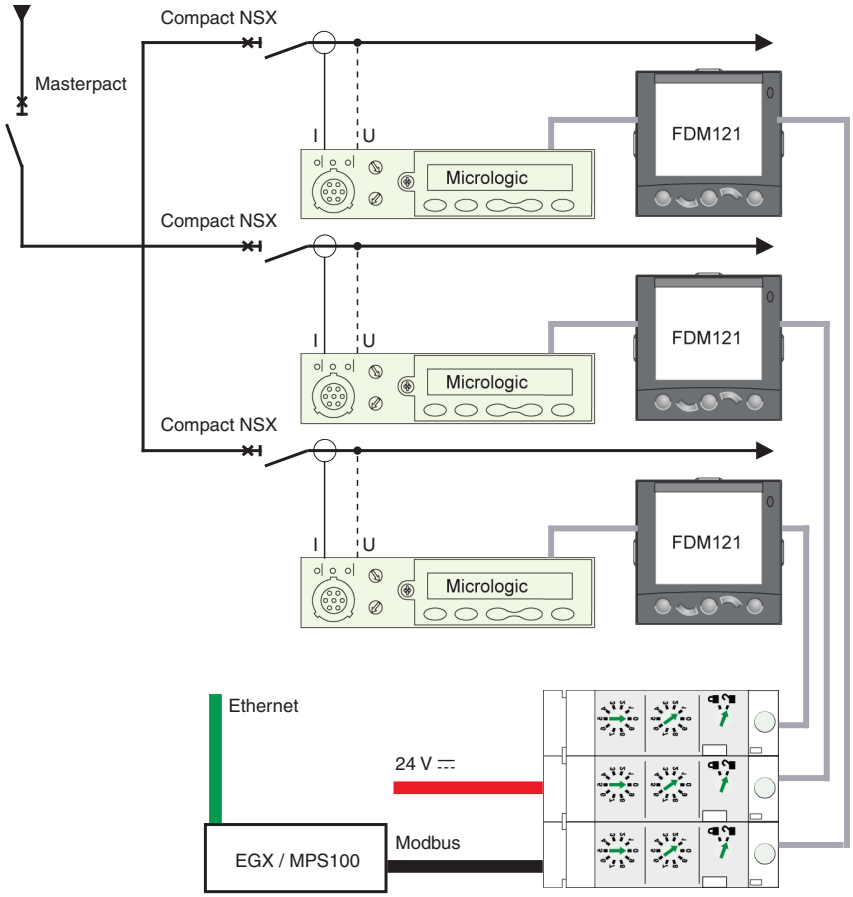
The figure below shows IMUs with metering, display, and Modbus communication functions:

- The metering function is performed by the Micrologic trip unit.
- The display function is performed by the front display module FDM121.
- The communication function is performed by the Modbus communication interface module.



The IMUs thus have, in addition to the Power Meter data and operating assistance data, communication and supervision functions.

The figure below shows the corresponding wiring diagram:



ULP System Architectures

2

Aim of this Chapter

This chapter describes the ULP system architectures.

The first section sets out the rules for ULP connection and supplying power to the intelligent modular units.

The second section sets out the rules for connection to the Modbus network.

The third section describes the ULP system architectures.

What's in this Chapter?

This chapter contains the following sections:

Section	Topic	Page
2.1	ULP Connection and Power Supply Rules	26
2.2	Rules for Connection to the Modbus Network	34
2.3	ULP System Architectures	41

2.1 ULP Connection and Power Supply Rules

Aim of this Section

This section sets out the rules for ULP connection and supplying power to the intelligent modular units (IMUs).

What's in this Section?

This section contains the following topics:

Topic	Page
Composition Rules for Intelligent Modular Units (IMUs)	27
Intelligent Modular Unit (IMU) with Draw-out Unit	30
ULP System Power Supply	32

Composition Rules for Intelligent Modular Units (IMUs)

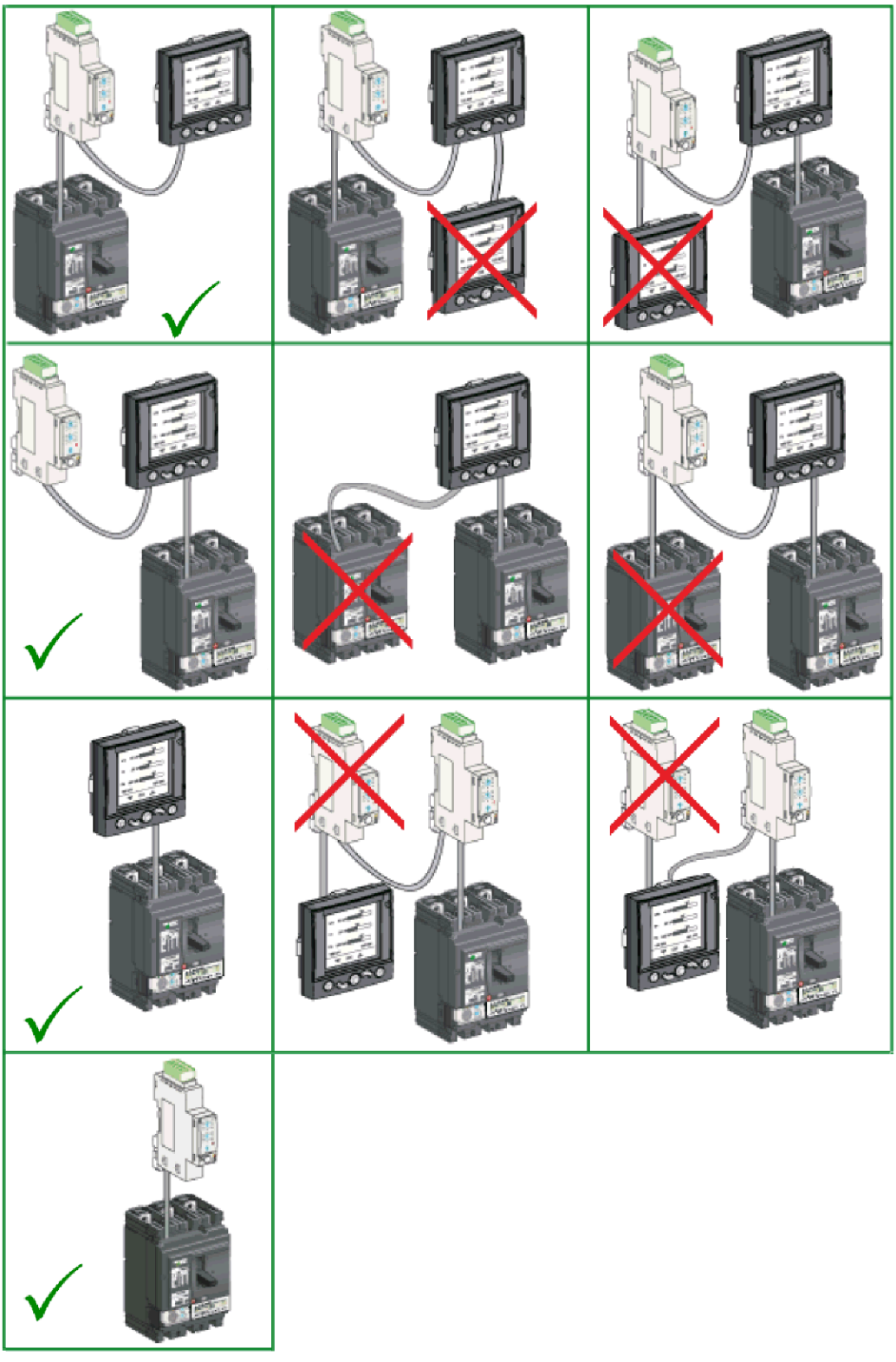
Introduction

Connection of IMU ULP modules has been designed to be simple. It complies with a certain number of rules concerning composition, ULP cables, and the ULP module power supply.

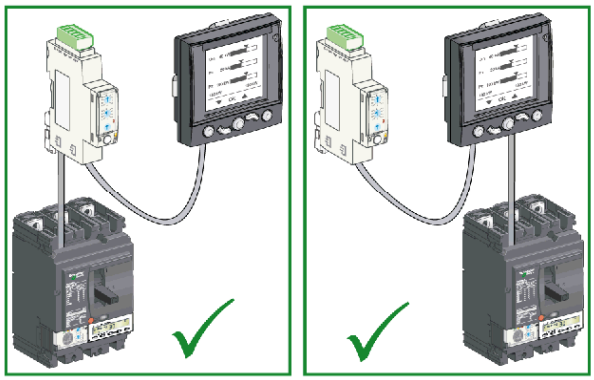
General Rules

The following rules apply to IMU structure:

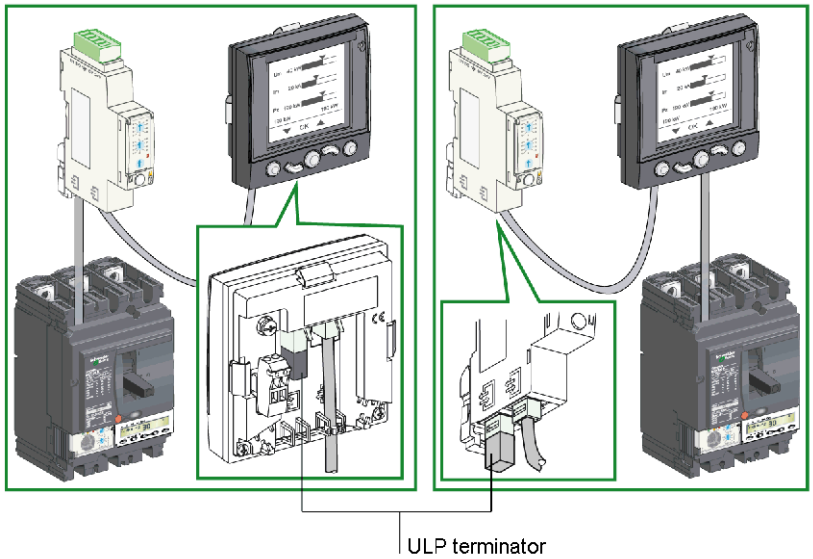
- An IMU contains a maximum of one ULP module of any given type. For example, an IMU cannot contain more than one front display module FDM121 or more than one Compact NSX circuit breaker.



- The ULP modules in a single IMU can be connected in any order. Connection must be guided by the cable routing and the desired layout for the ULP modules in the switchboard.

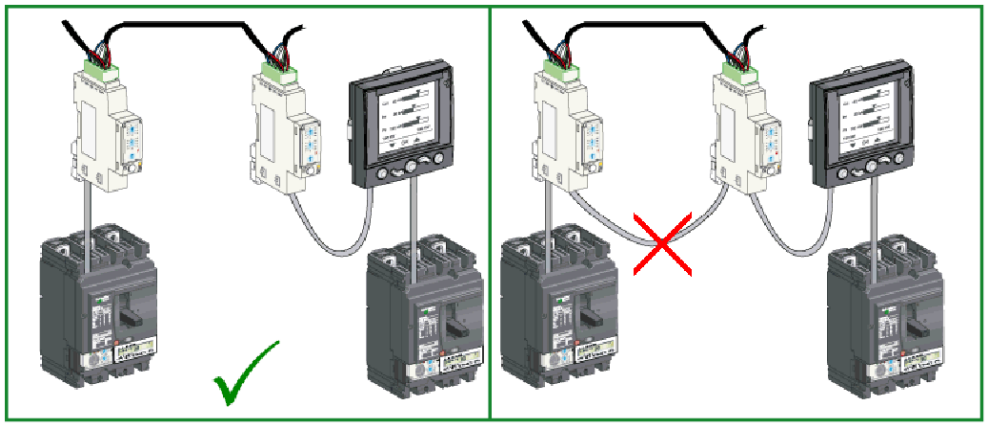


- The ULP modules placed at the end of the ULP line take a ULP terminator on the unused ULP connector.



Certain ULP modules, such as the Compact NSX circuit breaker, have an integral ULP terminator and should, therefore, always be placed at the end of the ULP line.

- IMUs must not be connected to one another by ULP cables. In the case of IMUs connected to a Modbus network, only the Modbus cable can be used to interconnect them.



Length of ULP Cables

The following rules apply to IMU ULP connection:

- The maximum length of the ULP cable between two IMU ULP modules is 10 m.
- The maximum length of all the ULP cables on a single IMU is 20 m.
- The total length of the ULP cables in the fixed part of an installation with a draw-out unit must be less than 12 m to ensure that the fixed part operates correctly when the unit is drawn out (see *Intelligent Modular Unit (IMU) with Draw-out Unit, page 30*).
- The bending radius of the ULP cables must be 50 mm minimum.

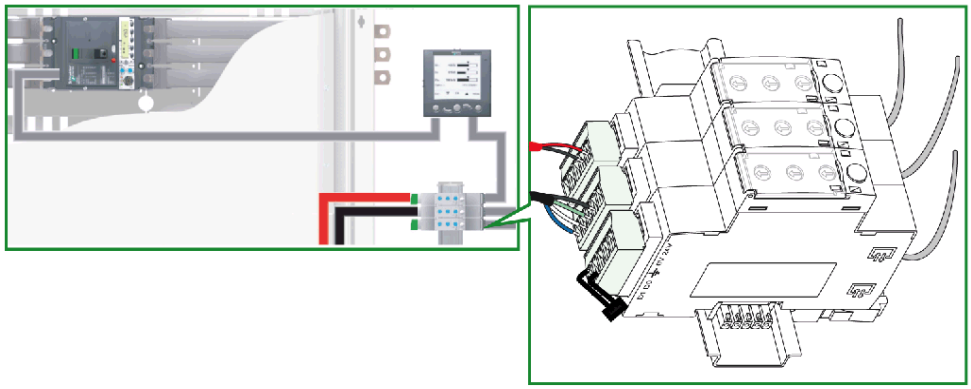
24 V DC Power Supply

The 24 V DC power supply is connected to a single ULP module which then distributes it to the other IMU modules by means of the ULP cables.

The 24 V DC power supply can be connected in one of two ways:

- In the case of an offline architecture (see *Standalone Architecture, page 43*), the 24 V DC power supply is connected to the front display module FDM121 supply terminal block:

- In all other cases, the 24 V DC power supply is connected to the Modbus communication interface module (see *Connection to the Modbus Communication Interface Module, page 36*):



For more information about IMU power supplies, refer to *ULP System Power Supply, page 32*.

Summary of Characteristics

The table below summarizes the IMU characteristics:

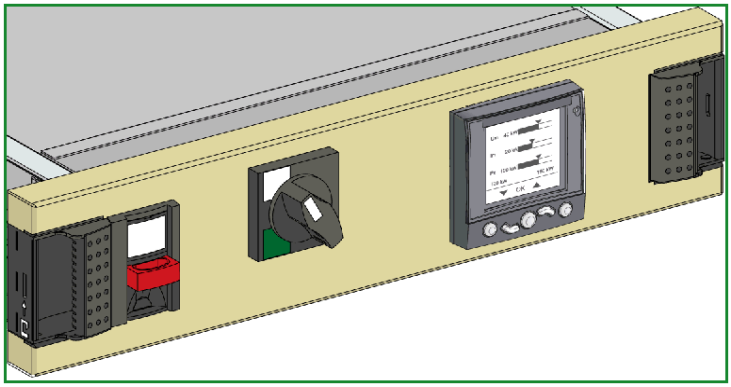
Characteristic	Value
Connection	Daisy-chaining of ULP cables and ULP terminator at the end of the ULP line
Maximum length	• 20 m in total for the IMU • 10 m between 2 ULP modules • 12 m for the fixed part in the case of an installation with a draw-out unit
Voltage range supported	24 V DC- 20% (19.2 V DC) to 24 V DC + 10% (26.4 V DC)
Maximum consumption per IMU	300 mA (see *ULP Module Consumption, page 32*)

Intelligent Modular Unit (IMU) with Draw-out Unit

Installation in a Draw-out Unit

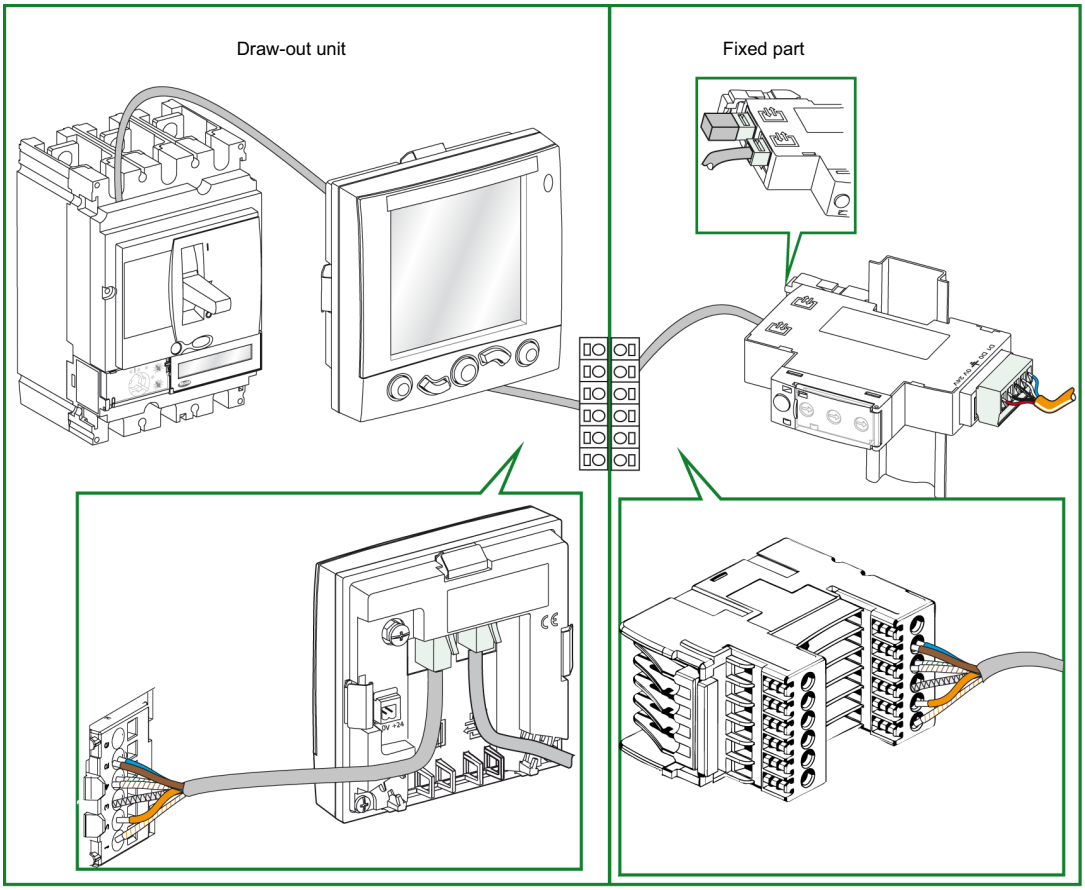
In equipment using draw-out units, the Compact NSX circuit breaker and possibly the front display module FDM121 are found in the draw-out unit. The Modbus communication interface module must always be in the fixed part.

The front display module FDM121 can be placed on the front of the draw-out unit:



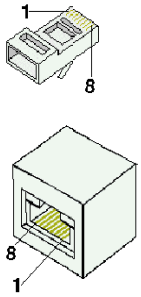
Connection of the Draw-out Unit

The ULP connection between the fixed part and the part built into the draw-out unit is made by means of the plug-in control terminal blocks on the unit:



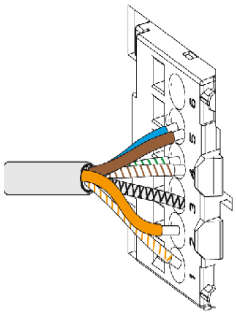
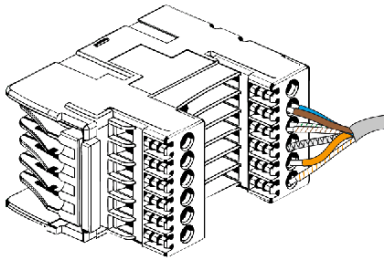
RJ45 Pin Connection

The ULP cable uses an RJ45 connector whose pin connection is described in the table below:

RJ45 Connector	Pin Number	Pair Number	Wire Color	Assignment
	Cover	Shielding	Braid	Shielding
	1	Pair 2	White-orange	Data (H)
	2	Pair 2	Orange	Data (L)
	3	Pair 3	White-green	0 V
	4	Pair 1	White-blue	Reserved
	5	Pair 1	Blue	24 V DC
	6	Pair 3	Green	Reserved
	7	Pair 4	White-brown	0 V
	8	Pair 4	Brown	24 V DC

Connection Procedure

The procedure for connecting the draw-out unit terminal block is as follows:

Step	Action
1	Cut a ULP cable and free the ends of the 8 wires from the sheath at both ends.
2	Twist the shielding braid into the form of a wire.
3	Strip the wires corresponding to pins 1-2-3-5-7-8 on the RJ45 connector (15 mm).
4	Cut the 2 unused wires (wires 4 and 6).
5	Twist the stripped ends of wires 3 and 7 (0 V) together; do the same with wires 5 and 8 (24 V DC).
6	Plug the five resulting conductors into the terminal block (removable side): ● Terminal 1: Wire for pin 1 (H data) ● Terminal 2: Wire for pin 2 (L data) ● Terminal 3: Bare shielding braid (ground) ● Terminal 4: Wire for pins 3 and 7 (0 V) ● Terminal 5: Wire for pins 5 and 8 (24 V DC) 
7	Plug the five ULP cable conductors into the terminal block on the fixed part in the same order. 

ULP System Power Supply

ULP Module Consumption

ULP modules are powered by a 24 V DC voltage distributed via the ULP cables.

To limit voltage drops on the ULP cables and the Modbus cable, the consumption of each IMU is limited to 300 mA.

The table below lists the consumption values for ULP modules:

Module	Typical Consumption (24 V DC at 20°C)	Maximum Consumption (19.2 V DC at 60°C)
Micrologic 5 or 6 trip unit for Compact NSX	30 mA	55 mA
BSCM for Compact NSX	9 mA	15 mA
2-wire RS 485 isolated repeater	15 mA	19 mA
Front display module FDM121	21 mA	30 mA
Modbus communication interface module	21 mA	30 mA
Maintenance module	0 mA (the maintenance module has its own power supply)	0 mA (the maintenance module has its own power supply)

Power Supply Rating

The rating of the 24 V DC power supply for the ULP modules must not exceed 3 A. This ensures that coordination is maintained between the power supply current limiting and the protection integrated in the ULP modules for an overload or short-circuit.

The power supply voltage of the furthest ULP module must be 24 V DC with a tolerance of between -20% (19.2 V DC) and +10% (26.4 V DC).

To comply with this range at the end of the Modbus cable when the power supply is distributed via the Modbus cable, the 24 V DC power supply output voltage must be controlled to:

- +/- 3% (23.3 V...24.7 V) for power supplies rated at 3 A
- +/- 5% (22.8 V...25.2 V) for power supplies rated at 1 A

Example 24 V DC Power Supplies

The table below gives examples of the 24 V DC power supplies to be used depending on the type of installation:

Description	Rating	Type of Installation	Part Number
24/30 V DC - 24 V DC - 1 A Primary overvoltage category IV Temperature : -25°C to +70°C	1 A	Installation limited to a few IMUs	54440
48/60 V DC - 24 V DC - 1 A Primary overvoltage category IV Temperature : -25°C to +70°C	1 A		54441
100/125 V DC - 24 V DC - 1 A Primary overvoltage category IV Temperature : -25°C to +70°C	1 A		54442
110/130 V AC - 24 V DC - 1 A Primary overvoltage category IV Temperature : -25°C to +70°C	1 A		54443
200/240 V AC - 24 V DC - 1 A Primary overvoltage category IV Temperature : -25°C to +70°C	1 A		54444
380/415V AC - 24 V DC - 1 A Primary overvoltage category IV Temperature : -25°C to +70°C	1 A		54445
100/500 V AC - 24 V DC - 3 A Primary overvoltage category II Temperature: : 0°C to +60°C (derated to 80% of the current above 50°C)	3 A	Large installation	ABL8RPS24030

Segmented Power Supply

Several 24 V DC power supplies are needed in the following cases:

- If the IMUs are divided between a number of switchboards, each switchboard must have its own 24 V DC power supply.
- If the total cumulative consumption of the IMUs within a single switchboard exceeds 3 A, the IMUs must be powered by different 24 V DC power supplies, keeping to a maximum consumption of 3 A for each power supply.
- In the case of IMUs using the Modbus protocol to communicate with the Modbus communication interface module (part number TRV00210), the 24 V DC power supply is distributed via the Modbus cable. If the length of the Modbus cable is such that the voltage drop is excessive (for example, cable longer than 15 m with a power supply rated at 3 A), Modbus cable segments with independent power supplies must be created: **Only the 24 V DC wire is interrupted between two 2 segments; the continuity of the 0 V wire (which is also the Modbus common) must be assured along the entire length of the Modbus network**. The maximum number of power supply segments is three for a single Modbus network, with a maximum rating of 3 A for each power supply segment.
- When an installation consists of a number of Modbus networks, one 24 V DC power supply must be used for each Modbus network. In fact, since the 0 V of the 24 V DC power supply is also the Modbus common, the power supplies must be separate in order to make the Modbus networks independent of one another.

Connection of the 0 V

⚠ WARNING

RISK OF ELECTROCUTION, ELECTRIC ARC OR BURNS

Connect the 0 V (Modbus common and 0 V of the 24 V DC power supply) to the protective ground.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The rules below must also be followed:

- Only one 0 V connection to the protective ground is accepted on a single Modbus network, at Modbus master or Ethernet gateway level, or at the top of each segment isolated by the 2-wire RS 485 isolated repeater module (part number TRV00211).
- Do not connect the 24 V of the 24 V DC power supply to the protective ground.
- If there are several power supply segments on a single Modbus network, the power supply must always be floating in relation to ground on the second and third segments.

Connection of the 24 V DC Power Supply Primary

The power supplies must be SELV (Safety Extra Low Voltage). To ensure insulation coordination (IEC 60664) and guarantee a SELV along the entire length of the ULP connections and Modbus links, the 24 V DC power supply must be connected at the primary end to a low-voltage distribution zone whose overvoltage category is less than or the same as that of the 24 V DC power supply.

- Power supplies in overvoltage category IV can be connected directly to the busbar system of a main LV distribution board.
  1 A power supplies (part numbers 54440 to 54445) are overvoltage category IV.
- Power supplies in an overvoltage category lower than IV cannot be connected directly to the busbar system of a main LV distribution board. Therefore, a minimum of one circuit isolation transformer is needed between the busbar system of a main LV distribution board and a control circuit that can be connected to the primary of the 24 V DC power supply.
  The 3 A power supply (part number ABL8RPS24030) is overvoltage category II, like most standard power supplies.

Using the 24 V DC Power Supply

⚠ DANGER

RISK OF ELECTROCUTION, ELECTRIC ARC OR BURNS

Do not connect products with single insulation to the ULP system's 24 V DC SELV power supply.

Failure to follow these instructions will result in death or serious injury.

The ULP system's 24 V DC SELV power supply can be used to power other products on condition that they have double insulation or reinforced insulation to retain the SELV nature of the power supply.

These products must not connect either the 0 V or the 24 V DC to the local machine ground or the protective ground.

2.2 Rules for Connection to the Modbus Network

Aim of this Section

This section sets out the rules for connecting intelligent modular units (IMUs) to the Modbus network.

What's in this Section?

This section contains the following topics:

Topic	Page
Connection of Modbus Communication Interface Modules	35
Connection to the Modbus Master	38

Connection of Modbus Communication Interface Modules

Introduction

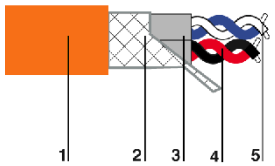
Intelligent modular units (IMUs) are connected to the Modbus network by means of the Modbus communication interface module (see *Modbus Communication Interface Module, page 68*).

The Modbus cable is used to interconnect the IMUs, to supply them with power, and to connect them to the Modbus master.

The maximum theoretical number of IMUs permitted on the same Modbus network is 31. In order to obtain acceptable communication performance (response times less than 2 s), it is advisable to limit the number of IMUs on the same Modbus network to twelve.

Composition of the Modbus Cable

The figure below shows the Modbus cable in detail:



1 Outer sheath
2 Shielding braid
3 Twisted pair sheaths
4 Communication pair (white/blue)
5 Power supply pair (red/black)

The Modbus cable has the following characteristics:

- Shielded cable with 2 twisted pairs:
  - 1 pair with 0.25 mm^2 cross-section for the RS485 signal (D0, D1)
  - 1 pair with 0.5 mm^2 cross-section for the power supply (0 V, 24 V DC)
- Shielding braid to be connected to the ground terminal of the Modbus communication interface module 5-pin connector
- External diameter: 8.7... 9.6 mm
- Color of outer sheath: Orange

The 0 V of the power supply pair is also the Modbus common, i.e. the 0 V for the RS485 earth leakage protection pair (D0, D1).

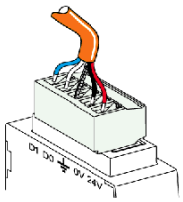
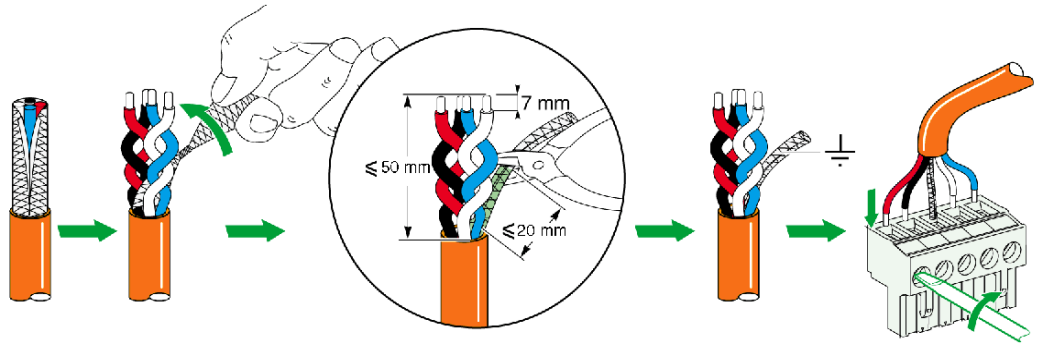
The 0 V (Modbus common) must be distributed along the entire length of the network, right up to the Modbus master.

	Description	Part Number
	Shielded cable with 2 twisted pairs L = 60 m	50965

Other Modbus cable part numbers are given in the Appendix: *Modbus Cable Characteristics, page 135*.

Connection to the Modbus Communication Interface Module

Each point on the Modbus communication interface module 5-pin connector has a specific marking to make it easier to connect the Modbus cable.

Connector	Marking	Color	Description	Unsheathed Length	Stripped Length
	D1	Blue	Modbus earth leakage protection pair: D1: RS 485 B/B' or Rx+/Tx+ signal D0: RS 485 A/A' or Rx-/Tx- signal	5 cm max.	7 mm
	D0	White			
	⏚	–	Modbus cable shielding braid, connected to the local machine ground in the Modbus communication interface module	2 cm max. (1)	7 mm
	0 V	Black	0 V for Modbus common and power supply	5 cm max.	7 mm
	24 V	Red	24 V DC for the power supply		
					

(1) To ensure that the shielding is effective against high-frequency disturbances, keep the shielding braid between the Modbus cable and the ground terminal as short as possible.

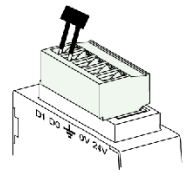
NOTE: Do not connect more than two wires in the same terminal on the Modbus communication interface module 5-pin connector.

Modbus Terminator

The Modbus cable communication pair has a typical impedance of 120 Ω. The Modbus cable must, therefore, be terminated at each end by a Modbus terminator with a 120 Ω impedance.

The Modbus master is at one end of the Modbus cable and usually has a switchable termination impedance. At the other end of the Modbus cable, a Modbus terminator with a 120 Ω impedance must be connected.

To obtain a 120 Ω impedance at high frequency without loading the cable with DC, the Modbus terminator is optimized in the form of an RC cell: 120 Ω in series with a 1 nF capacitor and two 10 cm wires for direct connection (between D0 and D1) to the 5-pin connector on the last Modbus communication interface module.

	Description	Part Number
	2 Modbus terminators (120 Ω + 1 nF)	VW3A8306DRC

General Rules Concerning Modbus Cable Length

The maximum permissible length for the Modbus network (for the main segment, excluding tap links) is 500 m at 38,400 baud and 1000 m at 19,200 baud.

The Modbus cable connecting the Modbus communication interface modules in the ULP system incorporates both the Modbus communication network and the 24 V DC power supply. Because of the stresses caused by a drop in the supply voltage, more restrictive limitations are imposed:

- The drop in the supply voltage between the power supply and the furthest point (on both the + 24 V wire and on the 0 V wire) must be limited to 4 V (2 V on the + 24 V wire and 2 V on the 0 V wire). A minimum power supply voltage equal to 24 V - 20% (19.2 V) is thereby obtained on the last Modbus communication interface module, with a 24 V DC power supply controlled as follows:
  - +/- 3% (23.3 V...24.7 V) for power supplies rated at 3 A
  - +/- 5% (22.8 V...25.2 V) for power supplies rated at 1 A
- For optimum Modbus communication quality, the voltage on the 0 V terminal on each Modbus communication interface module (Modbus common) must not vary by more than +/- 4 V compared to the 0 V voltage of any other Modbus product in the installation. This restriction means there is an additional limit on length when the Modbus equipment is divided between a number of power supply segments.

For more information on the instructions for installing the Modbus cable, refer to the *Training manual - Electromagnetic compatibility*.

For more details of the Modbus cable lengths for each architecture in the ULP system, refer to *Presentation of the ULP System Architectures, page 42*.

Connection to the Modbus Master

Introduction

Connection to the Modbus master varies according to the two scenarios below:
- The Modbus RS 485 network is contained within the switchboard
- The Modbus RS 485 network is not contained within the switchboard

Modbus RS 485 Network Contained Within the Switchboard

The Modbus RS 485 network is contained within the switchboard when both conditions below are fulfilled:
- The Modbus RS 485 network between the Modbus communication interface modules is connected to a Modbus master integrated in the switchboard (a PLC, for example) or an EGX or MPS100 Ethernet gateway.
- The Modbus RS 485 network between the Modbus communication interface modules does not exit the switchboard to extend to another switchboard.

In this case, the Modbus master can be connected directly to the Modbus RS 485 network of the Modbus communication interface modules in the switchboard.

An example of a Modbus RS 485 network contained within the switchboard is provided in *Ethernet Connection Linking Two Switchboards, page 39*.

Modbus RS 485 Network Not Contained Within the Switchboard

The Modbus RS 485 network is not contained within the switchboard in the following scenarios:
- The Modbus RS 485 network between the Modbus communication interface modules is connected to a Modbus master outside the switchboard.
- The Modbus RS 485 network between the Modbus communication interface modules exits the switchboard to extend to another switchboard.

In this case, an isolation barrier needs to be inserted on the incomer of each switchboard, between the Modbus RS 485 network outside the switchboard and the Modbus RS 485 network inside the switchboard.

This isolation barrier can be:
- The 2-wire RS 485 isolated repeater module: part number TRV00211 *(see page 76)*
- A fiber-optic link interface

An example of a Modbus RS 485 network not contained within the switchboard is provided in *Modbus Connection Linking Two Switchboards, page 40*.

⚠ WARNING

RISK OF ELECTROCUTION, ELECTRIC ARC OR BURNS

Do not connect the Modbus RS 485 network inside the switchboard to a Modbus RS 485 network outside the switchboard without inserting an isolation barrier.

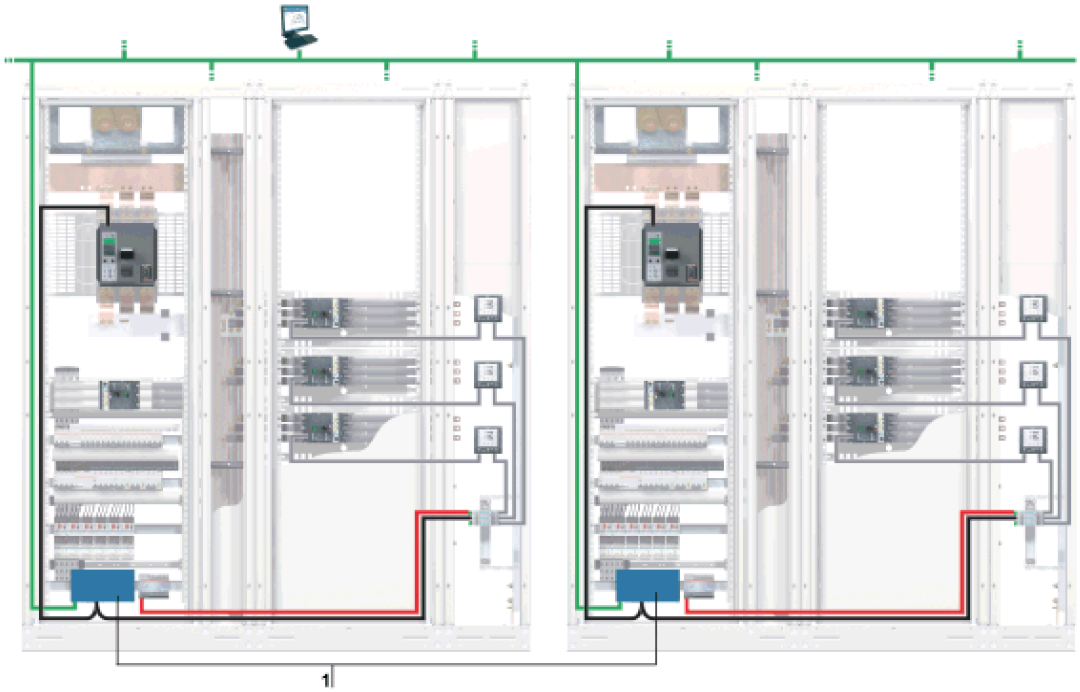
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Ethernet Connection Linking Two Switchboards

Two remote switchboards can be linked via an Ethernet connection, regardless of the distance or the ground equipotentiality between them. In this case, the Modbus RS 485 network is contained within the switchboards.

This solution is preferable to the isolation barrier (2-wire RS 485 isolated repeater module or fiber-optic link interface).

The figure below shows an Ethernet link connecting two switchboards, via EGX or MPS100 gateways:



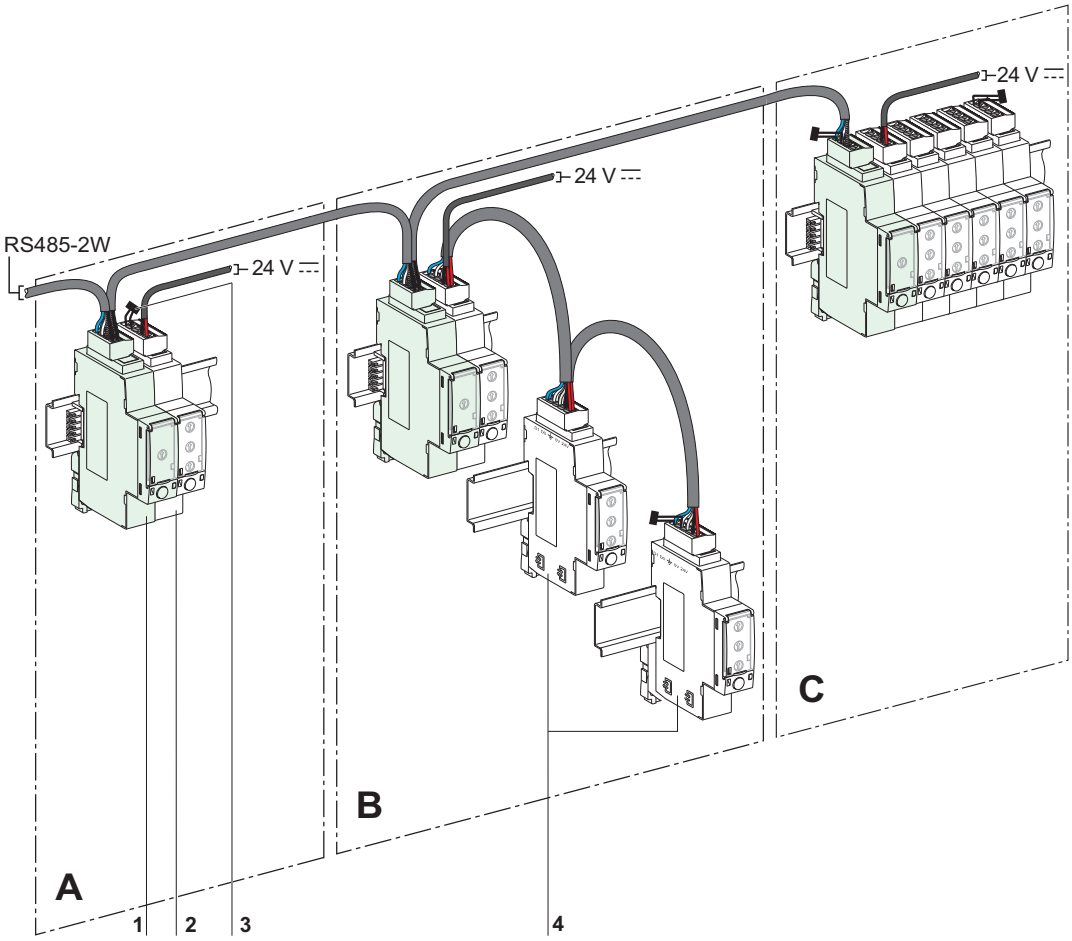
1 EGX or MPS100 gateway

The connection of the EGX or MPS Ethernet gateway to the Modbus RS 485 network inside the switchboard is shown in detail in *Wiring Diagram With Ethernet Gateway, page 46*.

Modbus Connection Linking Two Switchboards

When the 2-wire Modbus RS 485 network is not contained within the switchboard, the 2-wire RS 485 isolated repeater module needs to be inserted between the Modbus network inside the switchboard and the Modbus network outside the switchboard.

The following figure shows a Modbus link connecting three switchboards A, B, and C via 2-wire RS 485 isolated repeater modules:



1 2-wire RS 485 isolated repeater module
2 Modbus communication interface modules grouped in islands with the stacking accessory
3 Modbus terminator (part number VW3A8306DRC)
4 Modbus communication interface modules daisy-chained with the Modbus cable

The rules below must also be followed:

- Each isolated Modbus segment must include a polarization at one point, and a Modbus terminator at each end:
  - On the segment outside the switchboard, the line polarization and a terminator are usually integrated in the Modbus master, and a Modbus terminator (part number VW3A8306DRC) must be connected at the other end, i.e. on the last 2-wire RS 485 isolated repeater module (the one on switchboard C in this case).
  - On the segment inside the switchboard, the line termination (line polarization and Modbus terminator) is integrated in the 2-wire RS 485 isolated repeater module. A Modbus terminator must be connected at the other end, on the last Modbus communication interface module or other Modbus slave (on the last Modbus communication interface modules in switchboards A and B in this case).
- L is the length of the main segment of the Modbus cable (excluding tap links):
  - Lmax = 500 m at 38,400 baud
  - Lmax = 1000 m at 19,200 baud

The connection of the 2-wire RS 485 isolated repeater module to the Modbus networks inside and outside the switchboard is shown in detail in *2-wire RS 485 isolated repeater Module, page 76*.

2.3 ULP System Architectures

Aim of this Section

This section describes the ULP system architectures.

What's in this Section?

This section contains the following topics:

Topic	Page
Presentation of the ULP System Architectures	42
Standalone Architecture	43
Centralized Modbus Architecture	44
Daisy-Chained Distributed Modbus Architecture	51
Tap-Linked Distributed Modbus Architecture	57

Presentation of the ULP System Architectures

Introduction

The way in which the intelligent modular units (IMUs) are interconnected by the Modbus cable defines the ULP system architecture.

The various possible ULP system connections define three architectures:

- Standalone architecture: The IMUs are not communicating.
- Centralized Modbus architecture: The IMUs are communicating. The Modbus communication interface modules are grouped in islands, mounted side-by-side on a DIN rail and interconnected by means of the stacking accessory (see *Stacking Accessory, page 71*).
- Distributed Modbus architecture: The IMUs are communicating. The Modbus communication interface modules are distributed as close as possible to their IMU ULP modules and linked by the Modbus cable.
  There are two possible configurations for the distributed Modbus architecture:
  - Daisy-chained distributed Modbus architecture
  - Tap-linked distributed Modbus architecture

  Both these distributed architectures can be combined to form a mixed architecture.

The distributed and centralized architectures can be combined in order to adapt to the electrical installation and its restrictions.

Choice of Architecture

The table below lists the advantages and disadvantages of ULP system architectures:

Architecture	Advantages	Disadvantages
Centralized Modbus	• Easy wiring due to the stacking accessory • Ease of maintenance due to the grouping of Modbus communication interface modules in islands • Option of connecting other Modbus products via tap links, on the unused connectors of Modbus communication interface modules in the islands • Minimized Modbus cable length	• Need for a dedicated place in the column where the Modbus communication interface modules can be grouped together • Vertical distribution of ULP cables between the Modbus communication interface modules and their associated ULP modules
Daisy-chained distributed Modbus	• No need for a dedicated place in the column where the Modbus communication interface modules can be grouped together	• Additional wiring needed for daisy-chaining the Modbus cable between the Modbus communication interface modules • Longer Modbus cable • Space taken up in the column by the upstream and downstream Modbus cables
Tap-linked distributed Modbus	• No need for a dedicated place in the column where the Modbus communication interface modules can be grouped together • Shorter Modbus cable than that needed for the daisy-chained distributed Modbus architecture	• Additional wiring needed for daisy-chaining the Modbus cable between the Modbus communication interface modules • Need for a shunt terminal block at the top of each column

Standalone Architecture

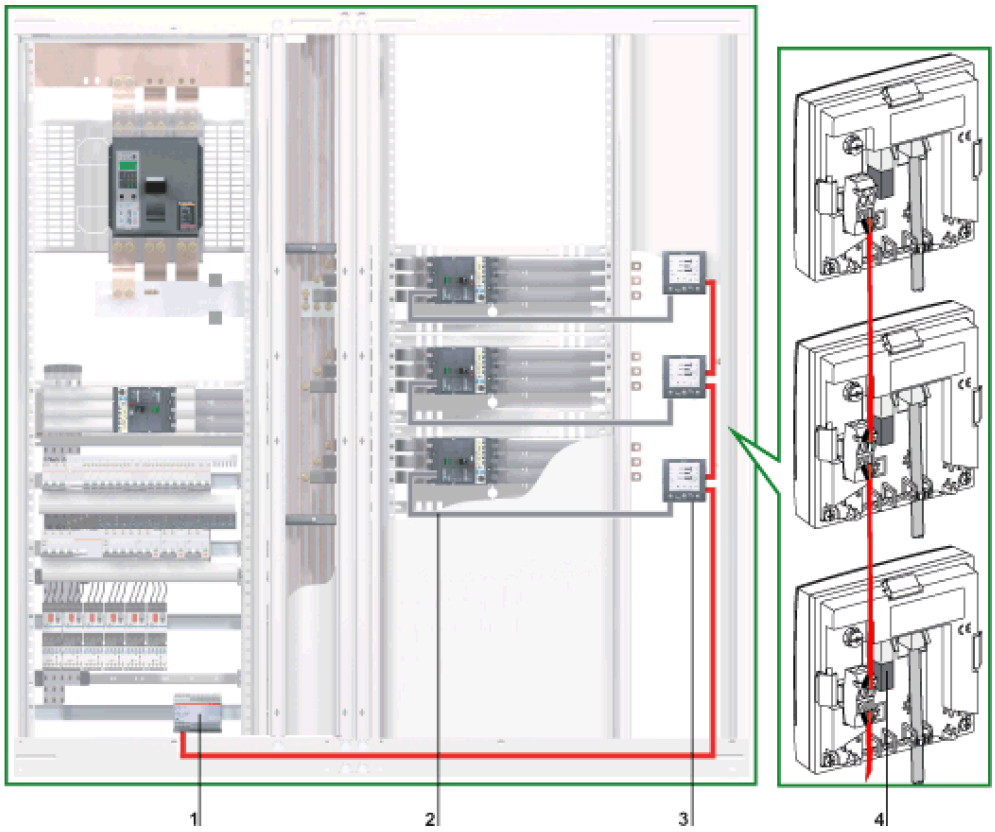
Introduction

When the intelligent modular units (IMUs) are not communicating, the architecture is classified as standalone.

Standalone Architecture

The figure below shows an example of a standalone architecture with IMUs consisting of a front display module FDM121 and a Compact NSX circuit breaker equipped with a Micrologic trip unit.

The IMUs do not communicate and do not therefore include a Modbus communication interface module. The IMUs are powered by an external power supply connected to the front display module FDM121.



1 24 VDC power supply
2 NSX cord
3 Front display module FDM121
4 ULP terminator

The front display module FDM121 mounting options are described in *Installing the Front Display Module FDM121, page 83*.

The 24 VDC power supply is selected from the list supplied in *Example 24 V DC Power Supplies, page 32*. The power supply rating must be selected according to IMU consumption.

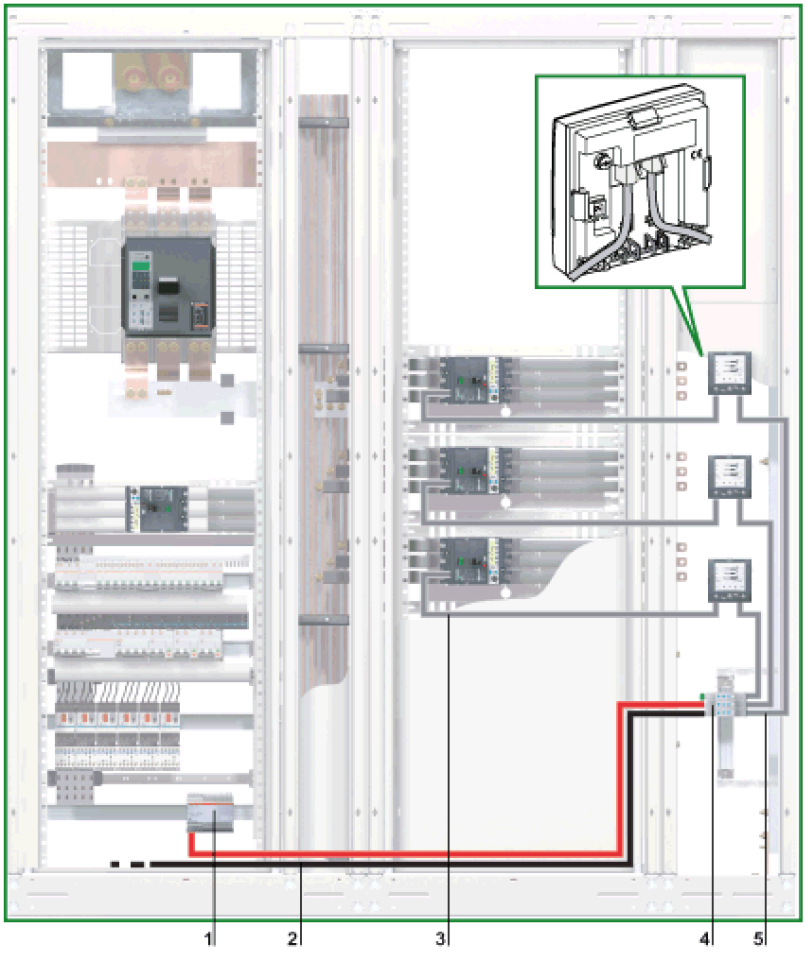
Centralized Modbus Architecture

Introduction

In a centralized Modbus architecture, the intelligent modular units (IMUs) are communicating. The Modbus communication interface modules are grouped in blocks, mounted side-by-side on a DIN rail and interconnected by means of the stacking accessory (see *Stacking Accessory, page 71*).

Centralized Modbus Architecture

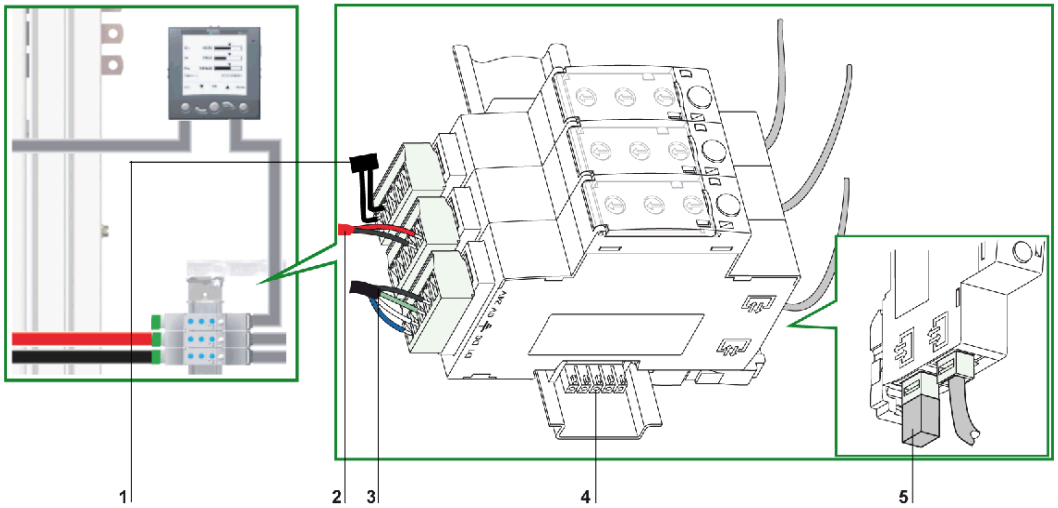
The figure below shows an example of a centralized Modbus architecture with IMUs consisting of a Compact NSX circuit breaker, a front display module FDM121 and a Modbus communication interface module.



1 24 VDC power supply
2 Modbus cable coming from Modbus master
3 NSX cord
4 Modbus communication interface modules grouped together with the stacking accessory
5 ULP cable

Modbus Cable Connection

The figure below shows the grouping of Modbus communication interface modules in detail:



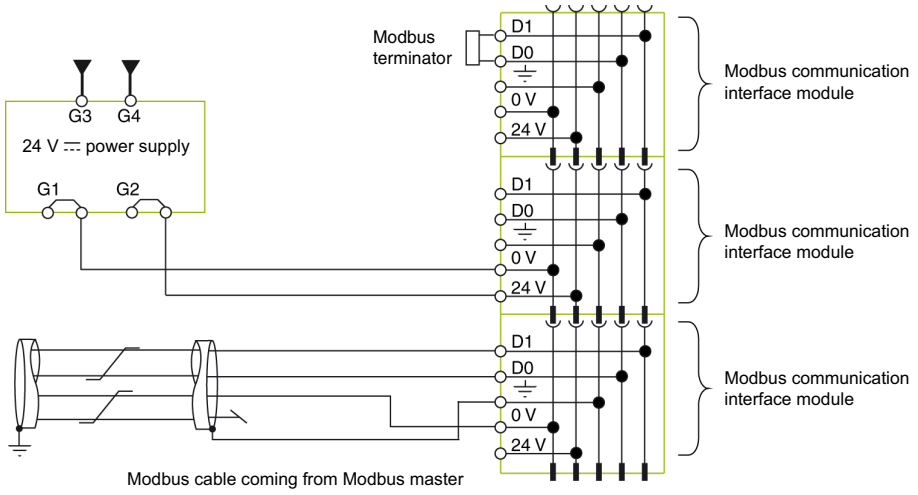
1 Modbus terminator
2 24 VDC power supply
3 Modbus cable coming from Modbus master
4 Stacking accessory
5 ULP terminator

The Modbus cable coming from the Modbus master is connected to a Modbus communication interface module. It ensures continuity of the Modbus signal (D0, D1 and 0 V). The 24 V wire is not connected when the master is powered separately.

Unused 5-pin connectors can be used to connect a Modbus tap link cable to another Modbus product (Modbus communication interface module for Masterpact circuit breaker, PM800 communicating power meter, etc.) or to connect the 24 V DC power supply.

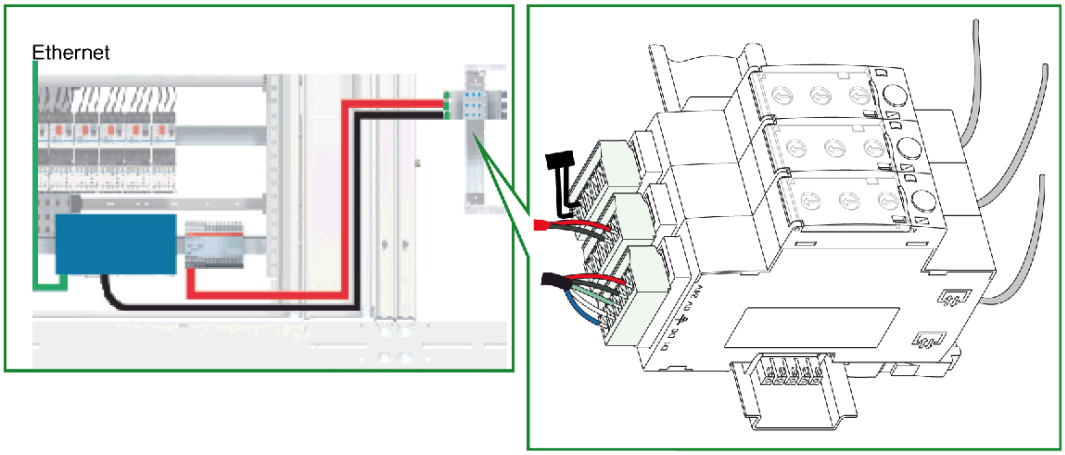
Wiring Diagram

The wiring diagram below shows the connections for the Modbus cable and the 24 VDC power supply in detail:



Ethernet Gateway Power Supply

When the Modbus master is an EGX or MPS100 Ethernet gateway placed directly in the switchboard, it can be powered by the ULP system's 24 VDC power supply:



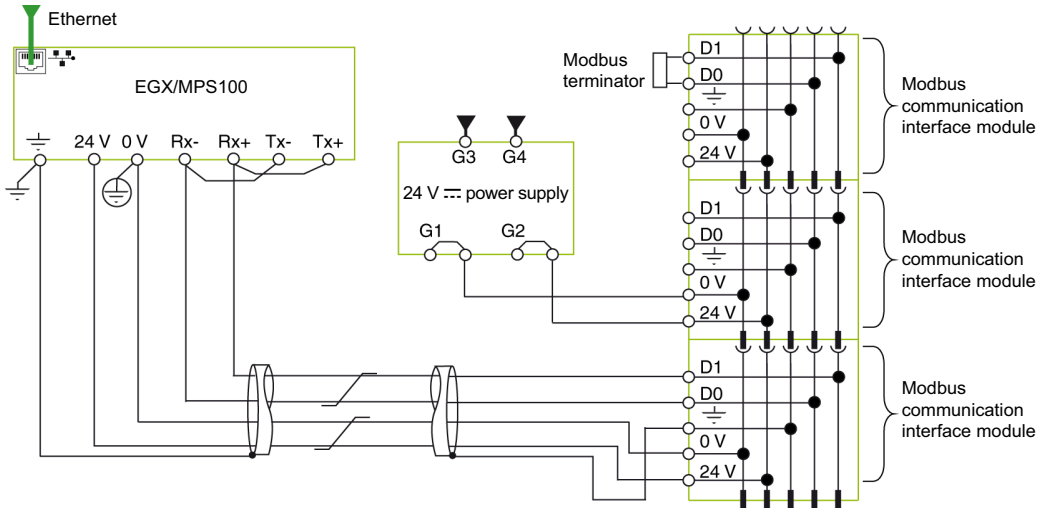
In this case, the 24 V wire of the Modbus cable coming from the EGX or MPS100 Ethernet gateway is connected: the EGX or MPS100 Ethernet gateway is therefore powered from the Modbus communication interface module.

However, you should check that the 24 V DC power supply used corresponds to the power supply rules for the EGX or MPS100 Ethernet gateway and that its rating is sufficient to power the Ethernet gateway and the IMUs in the switchboard.

For more information, refer to the EGX or MPS100 Ethernet gateway installation manual.

Wiring Diagram With Ethernet Gateway

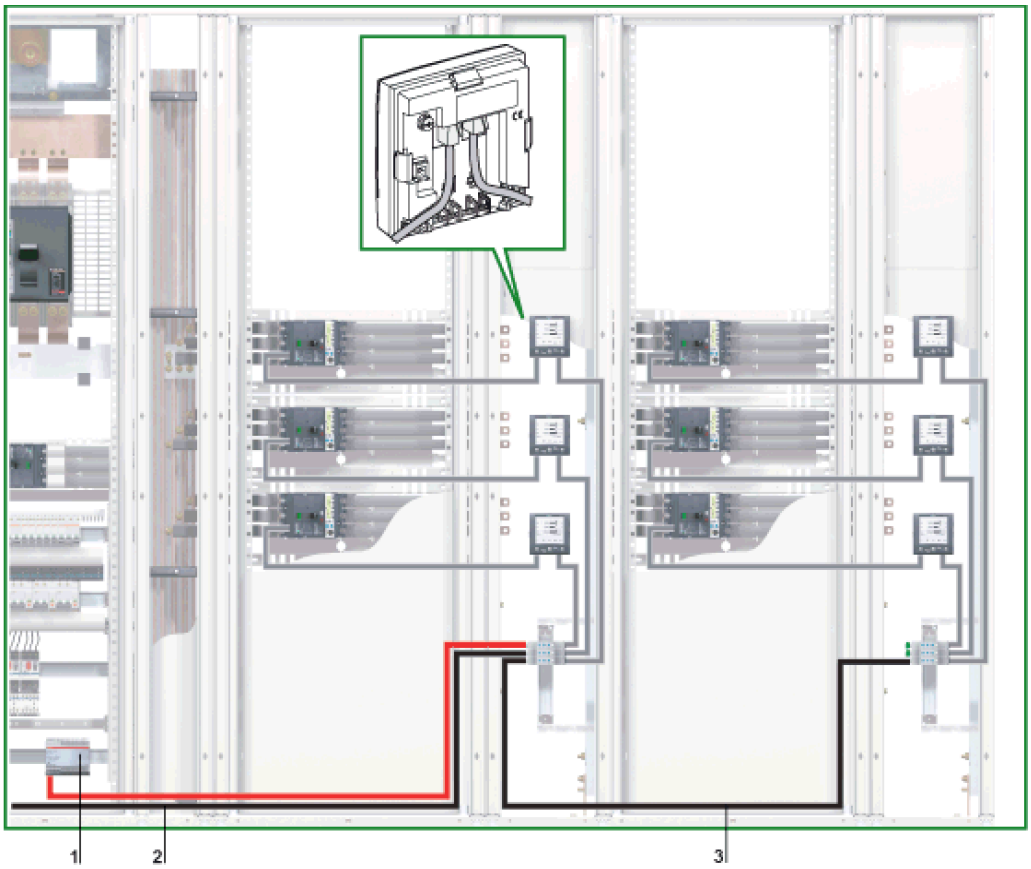
The wiring diagram below shows the connections for the EGX or MPS100 Ethernet gateway and the 24 VDC power supply in detail:



- The Modbus cable shielding and the EGX or MPS100 Ethernet gateway's functional ground terminal are connected to the local machine ground.
- The 0 V (Modbus common and 0 V of the 24 VDC power supply) is connected to the protective ground, **once and only once**, in the EGX or MPS100 Ethernet gateway.

Case of a Single Power Supply Segment

The figure below shows a centralized Modbus architecture with two columns and a single power supply segment:



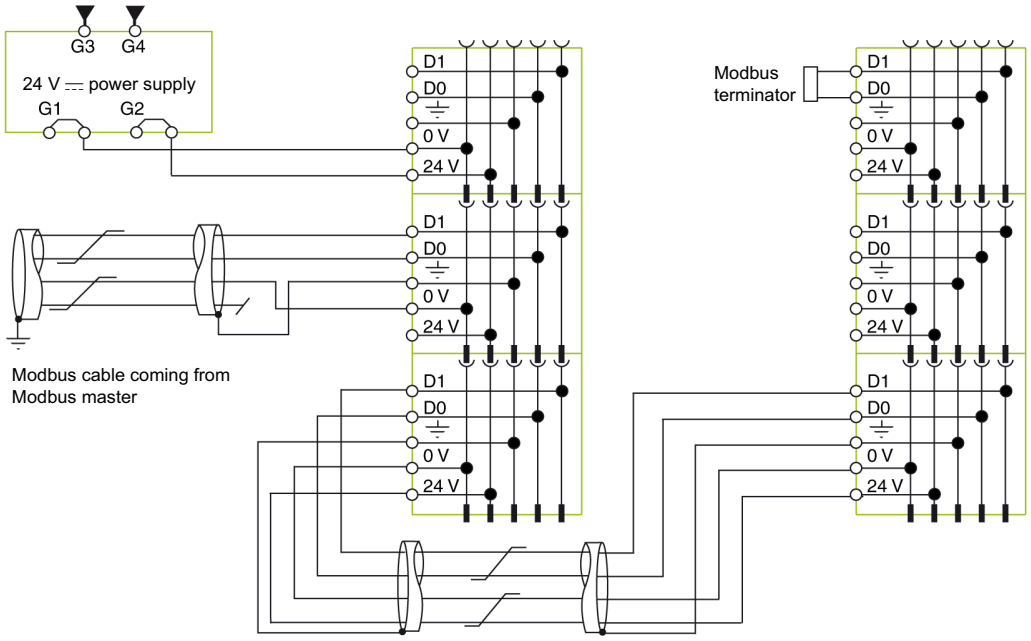
1 24 VDC power supply
2 Modbus cable coming from Modbus master
3 Modbus cable running to the second column

Modbus Cable Connection With a Single Power Supply Segment

- The Modbus cable coming from the Modbus master is connected to a Modbus communication interface module. It ensures continuity of the Modbus signal (D0, D1 and 0 V). The 24 V wire is not connected when the master is powered separately.
- The Modbus cable running to the second column can be connected to any Modbus communication interface module in the group. It ensures the continuity of the Modbus signal and the 24 VDC power supply to the second column.

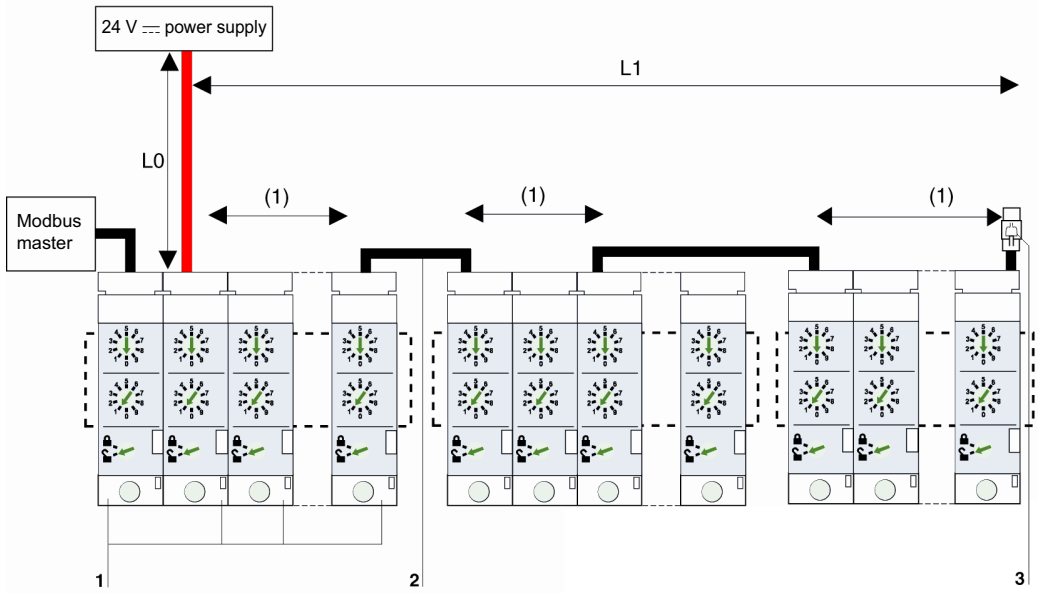
Wiring Diagram With a Single Power Supply Segment

The wiring diagram below shows the connections for the Modbus cables and the 24 VDC power supply in detail, in the case of a single power supply segment:



Modbus Cable Lengths for a Single Power Supply Segment

The figure below shows the Modbus cable lengths in detail, in the case of a centralized Modbus architecture with a single power supply segment:



1 Modbus communication interface modules grouped together with stacking accessories
2 Modbus cable ensuring continuity of the Modbus signal and the 24 V DC power supply
3 Modbus terminator

(1) The contact resistance between two 5-pin connectors in the group of Modbus communication interface modules should be counted as 1 m of Modbus cable when both Modbus cables are connected to two of the first seven Modbus communication interface modules, and as 2 m of Modbus cable thereafter.

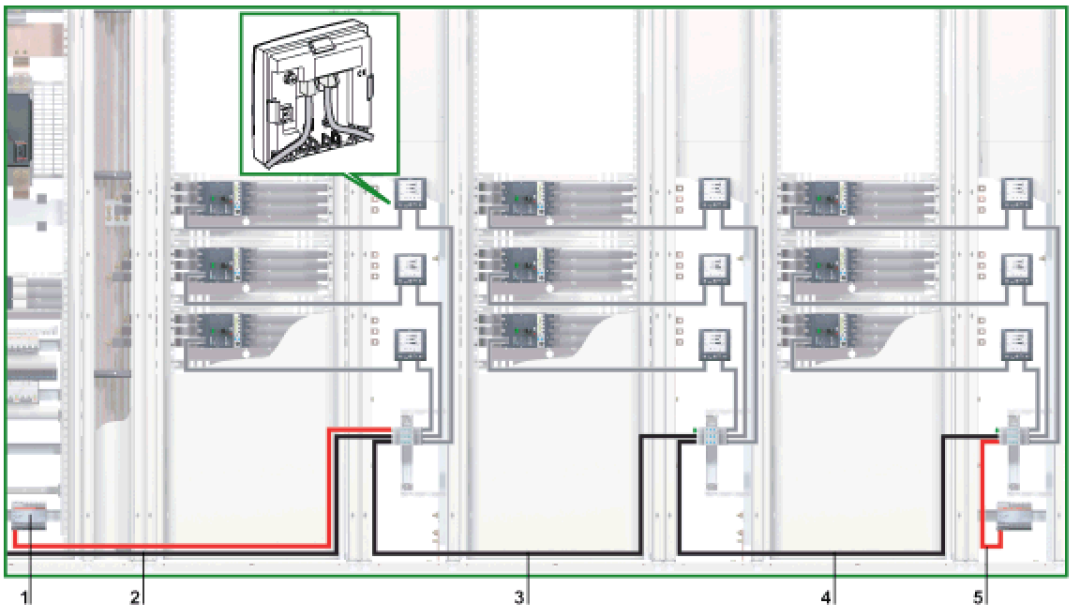
The table below indicates the maximum lengths of Modbus cable for the centralized Modbus architecture with a single power supply segment, and maximum power supply consumption (1 A or 3 A). The Modbus cable under consideration is described in *Connection of Modbus Communication Interface Modules, page 35*.

24 V DC Rating	L0 (in 0.75 mm^2 wires)	L1
1 A	5 m	45 m
3 A	3 m	15 m

Case of Several Power Supply Segments

When several 24 VDC power supplies are needed (see *Segmented Power Supply, page 33*), then several power supply segments are used along the Modbus cable.

The figure below shows a centralized Modbus architecture with two power supply segments:



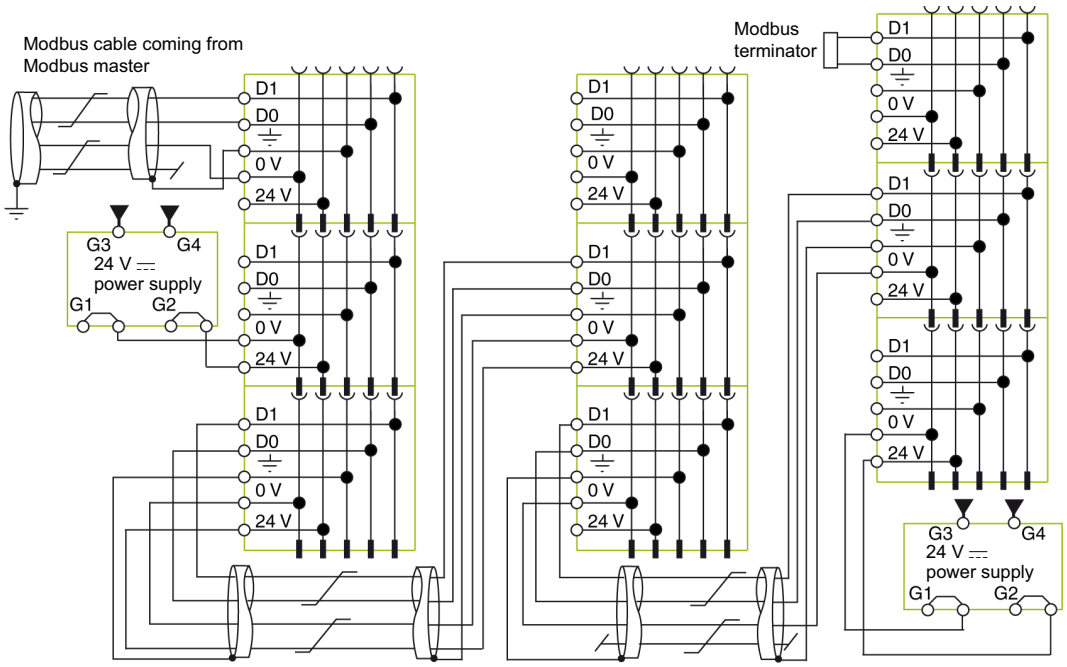
1 24 VDC power supply
2 Modbus cable coming from Modbus master
3 Modbus cable running to the second column
4 Modbus cable running to the third column
5 Insertion of a new 24 VDC power supply unit

Connection of the Modbus Cable With Several Power Supply Segments

- The Modbus cable coming from the Modbus master ensures continuity of the Modbus signal (D0, D1 and 0 V). The 24 V wire is not connected when the master is powered separately.
- The Modbus cable running to the second column ensures continuity of the Modbus signal (D0, D1 and 0 V) and the 24 VDC power supply for the second column.
- The Modbus cable running to the third column ensures continuity of the Modbus signal (D0, D1 and 0 V). The 24 V wire is not connected since a new 24 VDC power supply is connected for the third column.

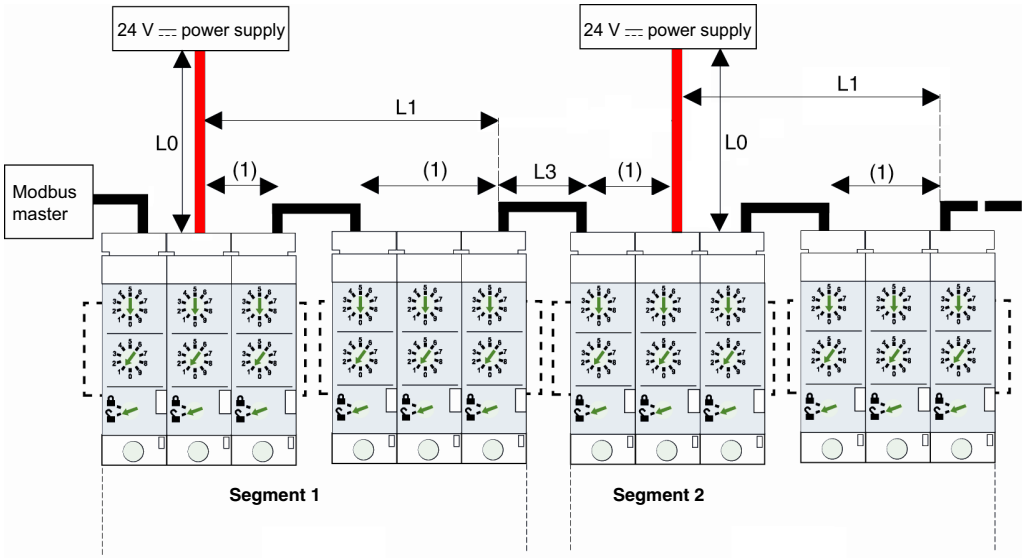
Wiring Diagram With Several Power Supply Segments

The wiring diagram below shows the connections in detail:



Modbus Cable Lengths for Several Power Supply Segments

The figure below shows the Modbus cable lengths in detail, in the case of a centralized Modbus architecture with several power supply segments:



(1) The contact resistance between two 5-pin connectors in the group of Modbus communication interface modules should be counted as 1 m of Modbus cable when both Modbus cables are connected to two of the first seven Modbus communication interface modules, and as 2 m of Modbus cable thereafter.

Modbus cable L3 ensures continuity of the Modbus signal (D0, D1 and 0 V). The 24 V wire is not connected since the power supply is connected separately.

The table below indicates the maximum lengths of Modbus cable for the centralized architecture with several power supply segments. The Modbus cable under consideration is described in *Connection of Modbus Communication Interface Modules, page 35*.

24 V DC Rating	L0 (in 0.75 mm^2 wires)	L1	Sum of the L1s (for all Power Supply Segments)	Sum of the L1s and L3s (Total Length)
1 A	5 m	45 m	105 m	500 m
3 A	3 m	15 m	35 m	500 m

NOTE: The maximum number of power supply segments is three segments for a single Modbus network, with a maximum rating of 3 A for each power supply segment (see *Segmented Power Supply, page 33*).

Daisy-Chained Distributed Modbus Architecture

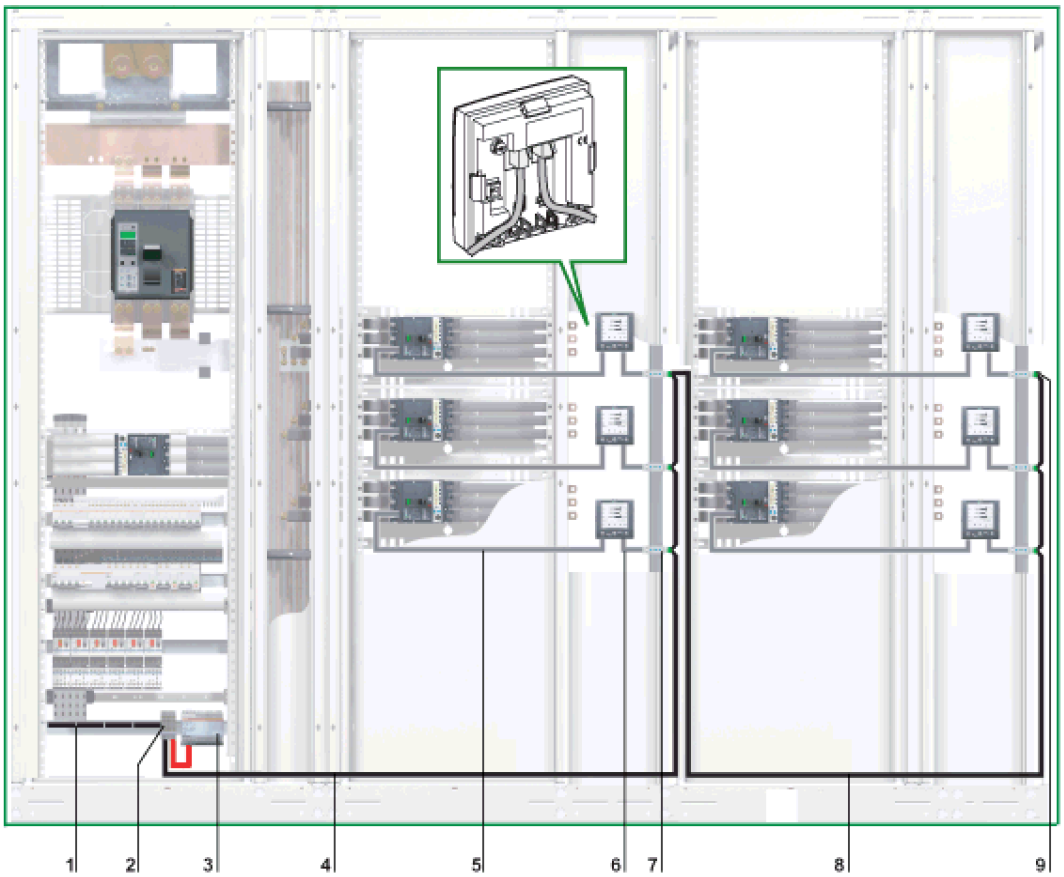
Introduction

In the distributed Modbus architecture, the Modbus communication interface modules are distributed as close as possible to their IMU ULP modules and linked by the Modbus cable.

For a daisy-chained distributed Modbus architecture, the main segment of the Modbus cable rises and falls directly in each switchboard column.

Daisy-Chained Distributed Modbus Architecture

The figure below shows an example of a daisy-chained distributed Modbus architecture with IMUs consisting of a Compact NSX circuit breaker, a front display module FDM121, and a Modbus communication interface module:



1 Modbus cable coming from Modbus master
2 Shunt terminal block on the incoming supply
3 24 V DC power supply
4 Modbus cable running to the first column
5 NSX cord
6 ULP cable
7 Modbus communication interface module
8 Modbus cable running to the second column
9 Modbus terminator

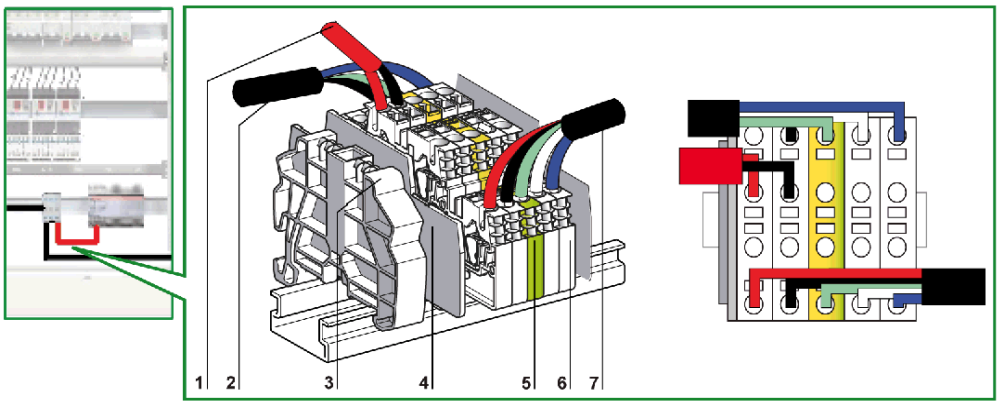
In the case of a distributed Modbus architecture, the Modbus communication interface module's 5-pin connector can be used to connect the upstream Modbus cable and the downstream Modbus cable in the same screw terminal.

Shunt Terminal Block on the Incoming Supply

The shunt terminal block on the incoming supply can be used to connect the Modbus cable and the power supply for all the IMUs.

The shunt terminal block consists of four 4-channel spring terminal blocks and one protective ground terminal block offering grounding of the Modbus cable shielding by connection to the DIN rail.

The figure below shows the shunt terminal block on the incoming supply in detail:



1 24 V DC power supply
2 Modbus cable coming from Modbus master
3 Snap-in plastic end stop
4 End cover
5 Protective ground terminal block
6 Spring terminal block
7 Modbus cable running to the first column

The table below lists the part numbers for the shunt terminal block:

Component	Nominal Cross-Section	Part Number
4-channel spring terminal block	2.5 mm^2	AB1 RRNETV235U4 (gray)
Protective ground terminal block	2.5 mm^2	AB1 RRNETP235U4 (green/yellow)
End cover	–	AB1 RRNAC244
Snap-in plastic end stop	–	AB1 AB8R35

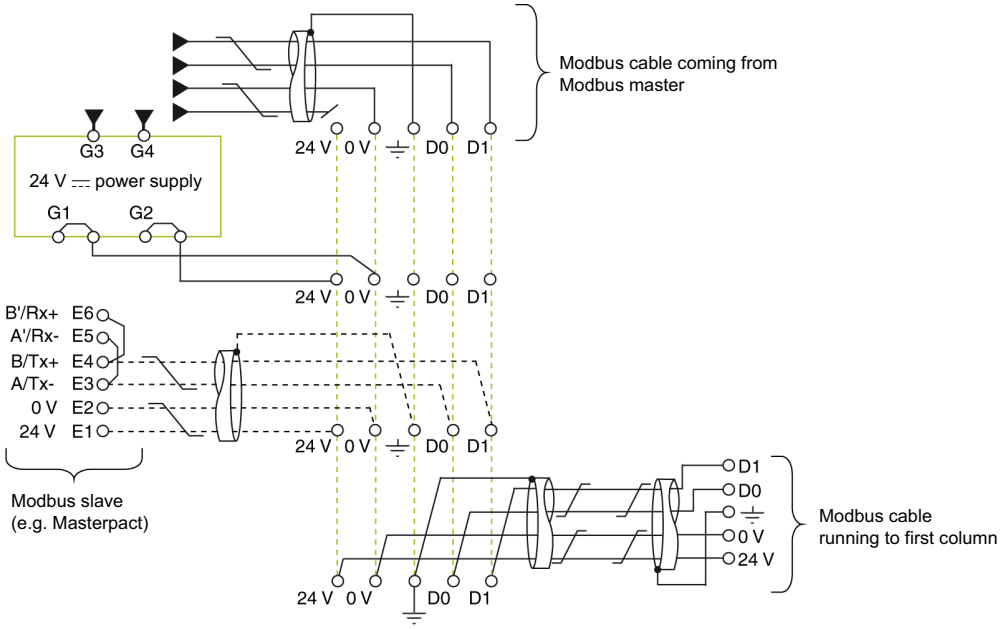
Modbus Cable Connection

- The Modbus cable from the Modbus master ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected when the master is powered separately.
- The Modbus cable running to the first column ensures continuity of the Modbus signal (D0, D1, and 0 V) and the 24 V DC power supply for the column.
- The unused channel on the shunt terminal block can be used to connect another Modbus slave in the switchboard (a Masterpact circuit breaker, for example).

NOTE: The same rules apply when connecting the Modbus cable to a terminal block as for its connection to the 5-pin connector on the Modbus communication interface module (same order of connection, same unsheathed length, and same stripped length). For more information, refer to *Connection to the Modbus Communication Interface Module, page 36*.

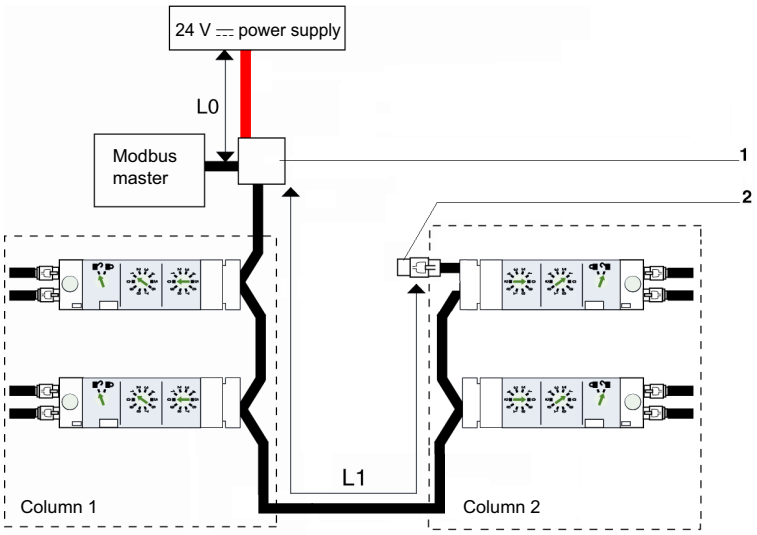
Wiring Diagram of Shunt Terminal Block on the Incoming Supply

The wiring diagram below shows the connections for the shunt terminal block on the incoming supply in detail:



Modbus Cable Lengths for a Single Power Supply Segment

The figure below shows the Modbus cable lengths for a daisy-chained distributed Modbus architecture with a single power supply segment in detail:



1 Shunt terminal block on the incoming supply
2 Modbus terminator

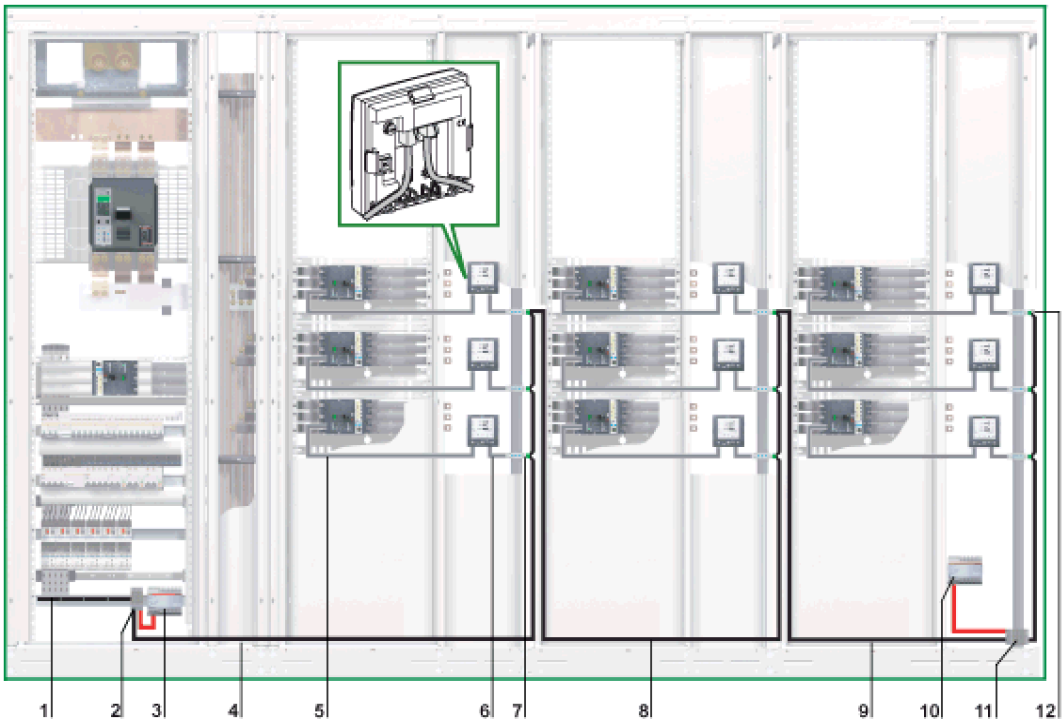
The table below summarizes the maximum Modbus cable lengths for the daisy-chained distributed Modbus architecture with a single power supply segment. The Modbus cable under consideration is described in *Connection of Modbus Communication Interface Modules, page 35*.

24 V DC Rating	**L0 (in 0.75 mm^2 Wires)**	**L1**
1 A	5 m	45 m
3 A	3 m	15 m

Case of Several Power Supply Segments

When several 24 V DC power supplies are needed (see *Segmented Power Supply, page 33*), then several power supply segments are used along the Modbus cable.

The figure below shows a daisy-chained distributed Modbus architecture with two power supply segments:



1 Modbus cable coming from Modbus master
2 Shunt terminal block on the incoming supply
3 24 V DC power supply
4 Modbus cable running to the first column
5 NSX cord
6 ULP cable
7 Modbus communication interface module
8 Modbus cable running to the second column
9 Modbus cable running to the third column
10 Insertion of a new 24 V DC power supply unit
11 Shunt terminal block on the column incomer
12 Modbus terminator

Shunt Terminal Block on the Incomer of the Third Column

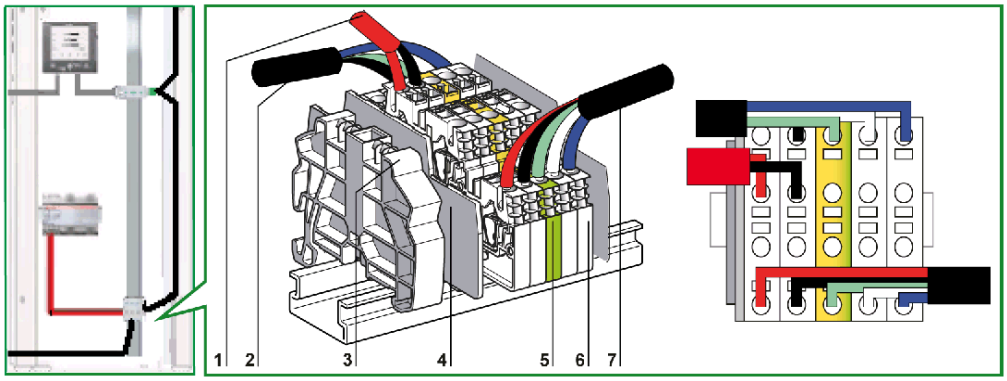
The shunt terminal block on the incomer of the third column can be used to connect a new 24 V DC power supply to power the IMUs in the third column.

The shunt terminal block consists of four 4-channel spring terminal blocks and one protective ground terminal block offering grounding of the Modbus cable shielding by connection to the DIN rail.

For the shunt terminal block part numbers, see *Shunt Terminal Block on the Incoming Supply, page 52*.

It is possible to create shunt terminal blocks using plug-in terminal blocks to make it easier to transport the switchboard. For more information, refer to *Plug-in Shunt Terminal Block, page 65*.

The figure below shows the shunt terminal block on the incomer of the third column in detail:



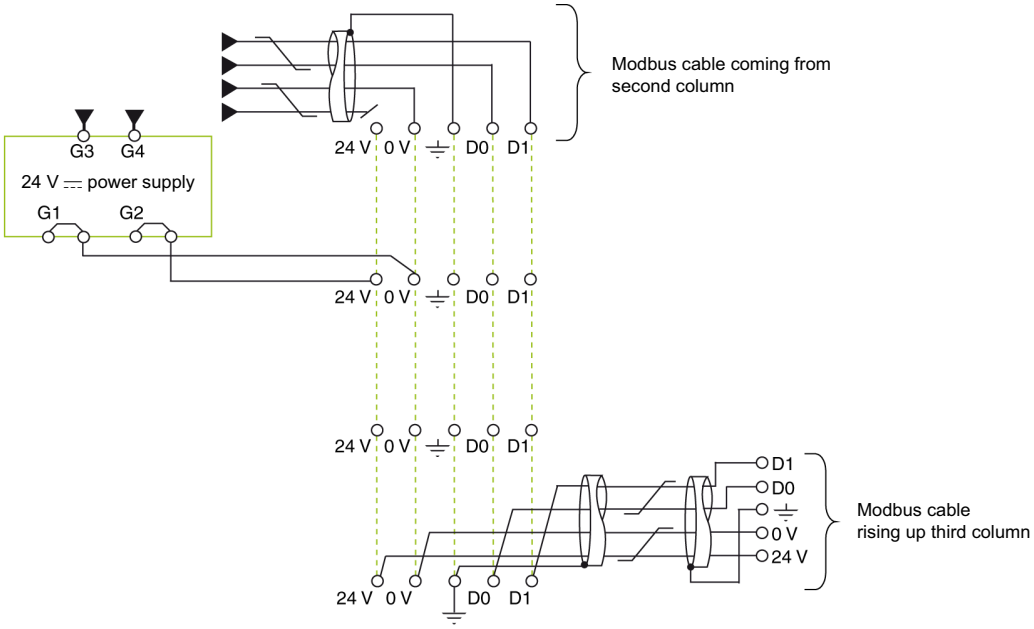
1 24 V DC power supply
2 Modbus cable coming from the second column
3 Snap-in plastic end stop
4 End cover
5 Protective ground terminal block
6 Spring terminal block
7 Modbus cable rising up the third column

Modbus Cable Connection

- The Modbus cable from the Modbus master ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected when the master is powered separately.
- The Modbus cable running to the first column ensures continuity of the Modbus signal (D0, D1, and 0 V) and the 24 V DC power supply for the column.
- The Modbus cable running to the second column ensures continuity of the Modbus signal (D0, D1, and 0 V) and the 24 V DC power supply for the second column.
- The Modbus cable running to the third column ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected since the power supply is connected separately for the third column.

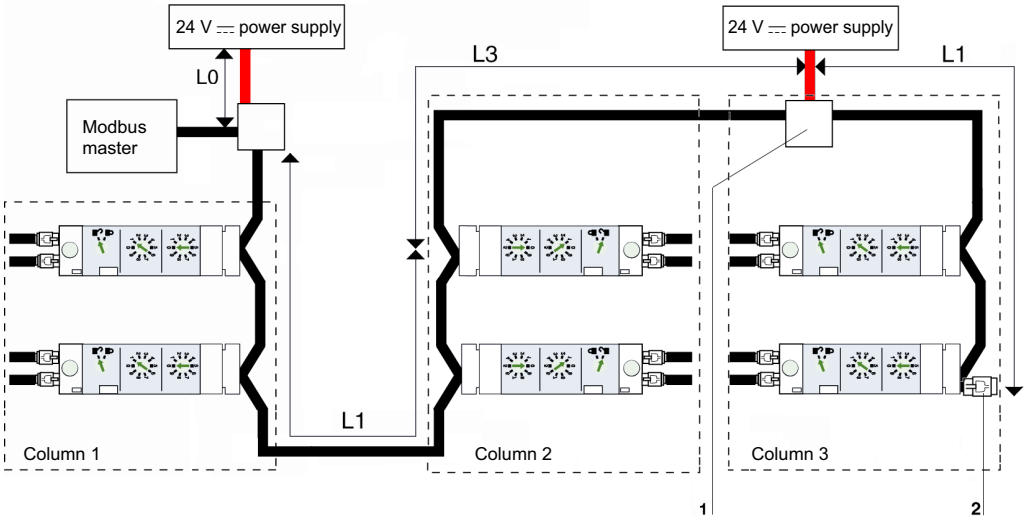
Wiring Diagram of Shunt Terminal Block on the Incomer of the Third Column

The wiring diagram below shows the connections for the shunt terminal block on the incomer of the third column in detail:



Modbus Cable Lengths for Several Power Supply Segments

The figure below shows the Modbus cable lengths for a daisy-chained distributed Modbus architecture with several power supply segments in detail:



1 Shunt terminal block on the column incomer
2 Modbus terminator

Modbus cable L3 ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected since the power supply is connected separately on the shunt terminal block on the column incomer.

The table below summarizes the maximum Modbus cable lengths for the daisy-chained distributed Modbus architecture with several power supply segments. The Modbus cable under consideration is described in *Connection of Modbus Communication Interface Modules, page 35*.

24 V DC Rating	L0 (in 0.75 mm^2 Wires)	L1	Sum of the L1s (for all Power Supply Segments)	Sum of the L1s and L3s (Total Length)
1 A	5 m	45 m	105 m	500 m
3 A	3 m	15 m	35 m	500 m

NOTE: The maximum number of power supply segments is three segments for a single Modbus network, with a maximum rating of 3 A for each power supply segment (see *Segmented Power Supply, page 33*).

Tap-Linked Distributed Modbus Architecture

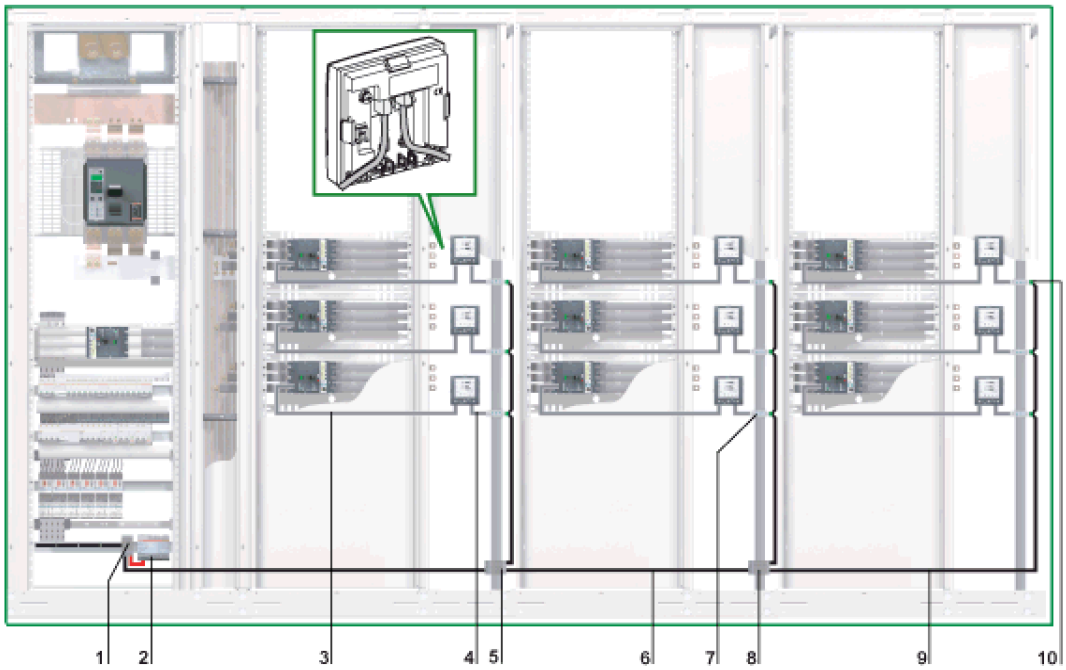
Introduction

In the distributed Modbus architecture, the Modbus communication interface modules are distributed as close as possible to their IMU ULP modules and linked by the Modbus cable.

For a tap-linked distributed Modbus architecture, the main segment of the Modbus cable has a shunt terminal block on the incomer of each column and the Modbus communication interface modules are connected on a tap link cable.

Tap-Linked Distributed Modbus Architecture

The figure below shows an example of a tap-linked distributed Modbus architecture with IMUs consisting of a Compact NSX circuit breaker, a front display module FDM121, and a Modbus communication interface module:



1 Shunt terminal block on the incoming supply
2 24 V DC power supply
3 NSX cord
4 ULP cable
5 Shunt terminal block on the column incomer
6 Modbus cable running to the second column
7 Modbus communication interface module
8 Shunt terminal block on the column incomer
9 Modbus cable running to the third column
10 Modbus terminator

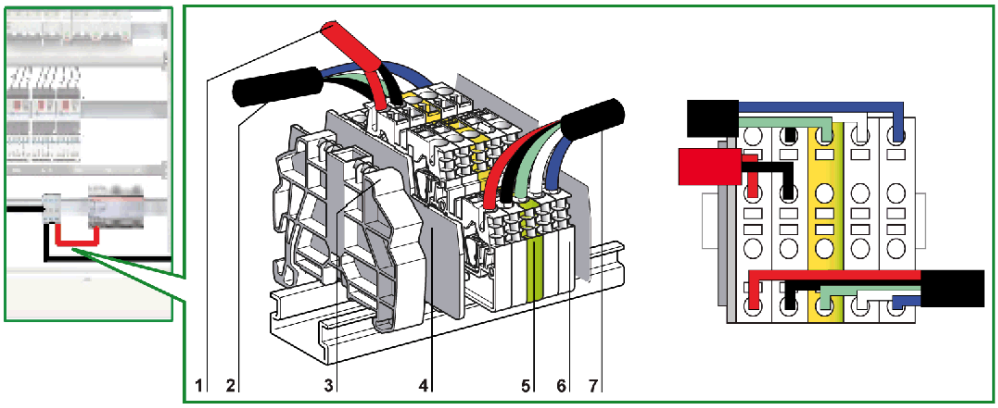
In the case of a distributed Modbus architecture, the Modbus communication interface module's 5-pin connector can be used to connect the upstream Modbus cable and the downstream Modbus cable in the same screw terminal.

Shunt Terminal Block on the Incoming Supply

The shunt terminal block on the incoming supply can be used to connect the Modbus cable and the power supply for all the IMUs.

The shunt terminal block consists of four 4-channel spring terminal blocks and one protective ground terminal block offering grounding of the Modbus cable shielding by connection to the DIN rail.

The figure below shows the shunt terminal block on the incoming supply in detail:



1 24 V DC power supply
2 Modbus cable coming from Modbus master
3 Snap-in plastic end stop
4 End cover
5 Protective ground terminal block
6 Spring terminal block
7 Modbus cable running to the first column

The table below lists the part numbers for the shunt terminal block:

Component	Nominal Cross-Section	Part Number
4-channel spring terminal block	2.5 mm^2	AB1 RRNETV235U4 (gray)
Protective ground terminal block	2.5 mm^2	AB1 RRNETP235U4 (green/yellow)
End cover	–	AB1 RRNACE244
Snap-in plastic end stop	–	AB1 AB8R35

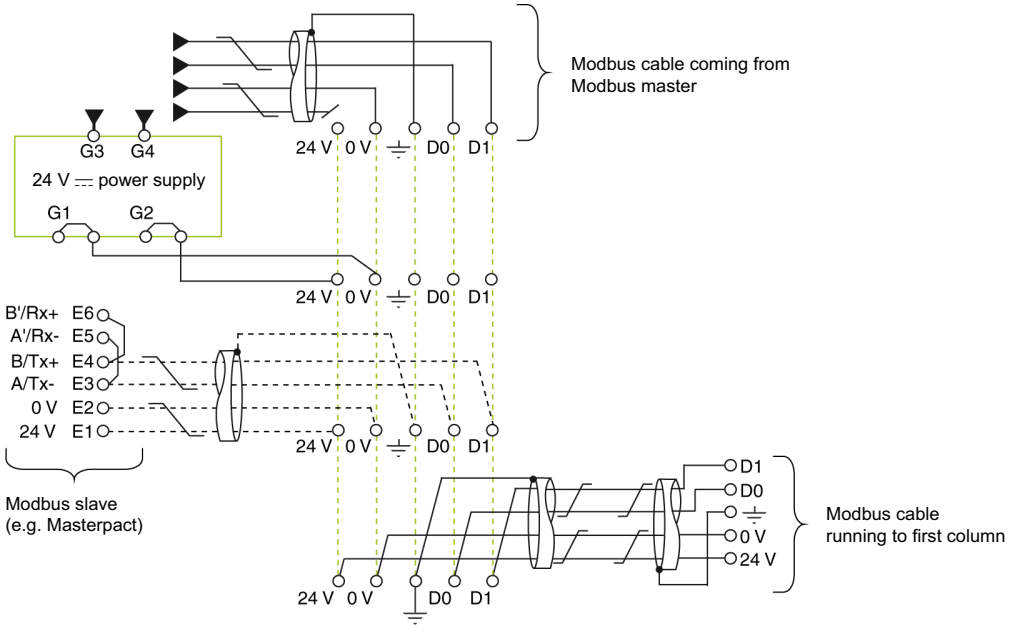
Modbus Cable Connection

- The Modbus cable from the Modbus master ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected when the master is powered separately.
- The Modbus cable running to the first column ensures continuity of the Modbus signal (D0, D1, and 0 V) and the 24 V DC power supply for the column.
- The unused channel on the shunt terminal block can be used to connect another Modbus slave in the switchboard (a Masterpact circuit breaker, for example).

NOTE: The same rules apply when connecting the Modbus cable to a terminal block as for its connection to the 5-pin connector on the Modbus communication interface module (same order of connection, same unsheathed length, and same stripped length). For more information, refer to *Connection to the Modbus Communication Interface Module, page 36*.

Wiring Diagram of Shunt Terminal Block on the Incoming Supply

The wiring diagram below shows the connections for the shunt terminal block on the incoming supply in detail:



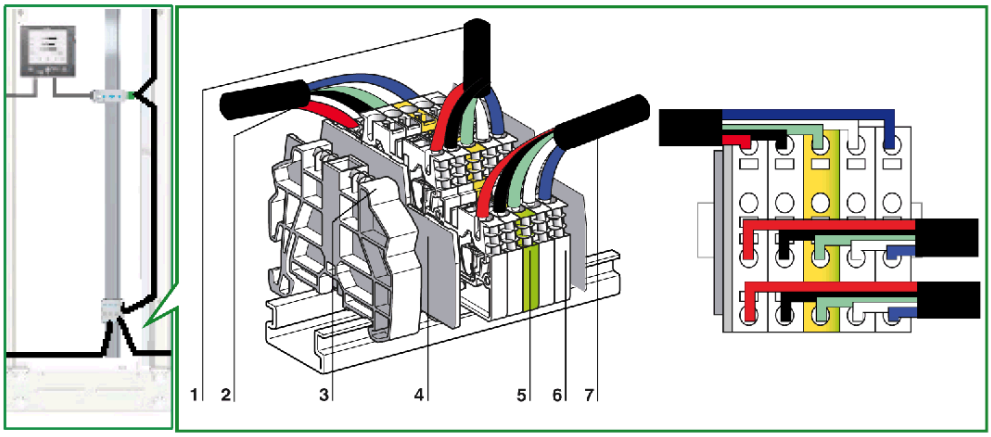
Shunt Terminal Block on the Column Incomer

The shunt terminal block on the column incomer distributes the Modbus signal and the 24 V DC power supply to the columns in the switchboard.

The shunt terminal block is created using four 4-channel spring terminal blocks and one protective ground terminal block offering grounding of the Modbus cable shielding by connection to the DIN rail.

For the shunt terminal block part numbers, see *Shunt Terminal Block on the Incoming Supply, page 58*.

The figure below shows the shunt terminal block on the column incomer in detail:

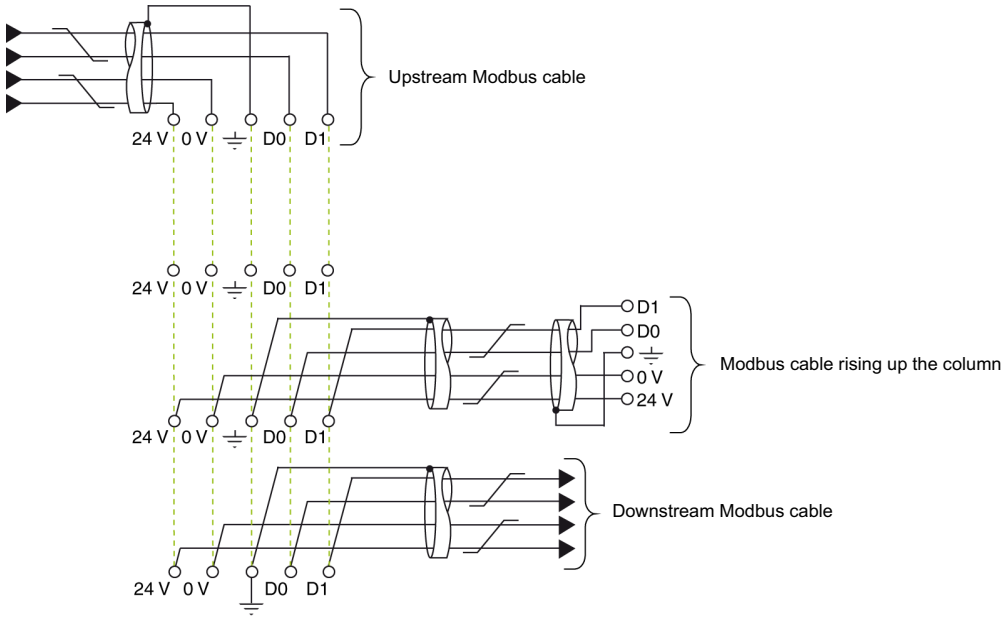


1 Modbus cable rising up the column
2 Upstream Modbus cable
3 Snap-in plastic end stop
4 End cover
5 Protective ground terminal block
6 Spring terminal block
7 Downstream Modbus cable

It is possible to create shunt terminal blocks using plug-in terminal blocks to make it easier to transport the switchboard. For more information, refer to *Plug-in Shunt Terminal Block, page 65*.

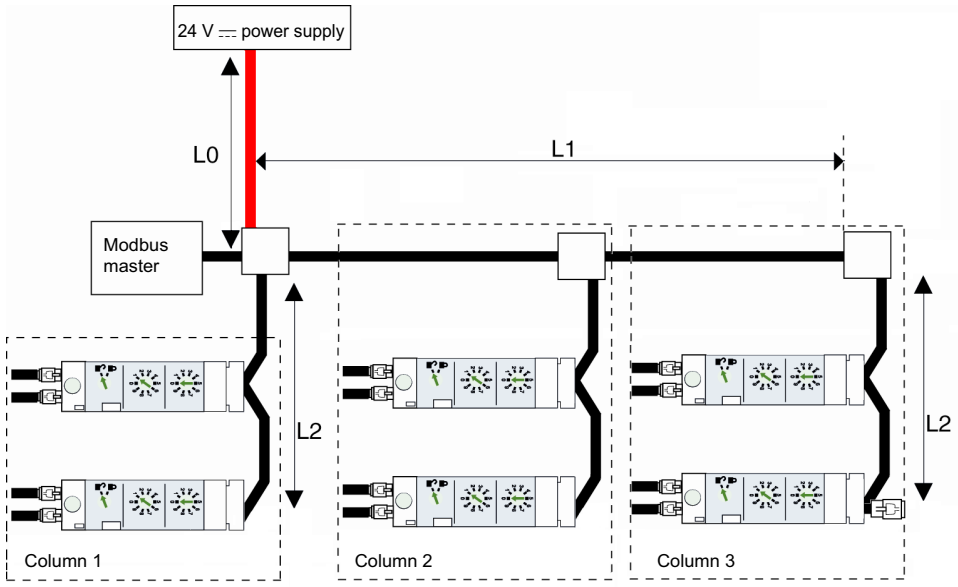
Wiring Diagram of Shunt Terminal Block on the Column Incomer

The wiring diagram below shows the connections for the shunt terminal block on the column incomer in detail:



Modbus Cable Lengths for a Single Power Supply Segment

The figure below shows the Modbus cable lengths for a tap-linked distributed Modbus architecture with a single power supply segment in detail:



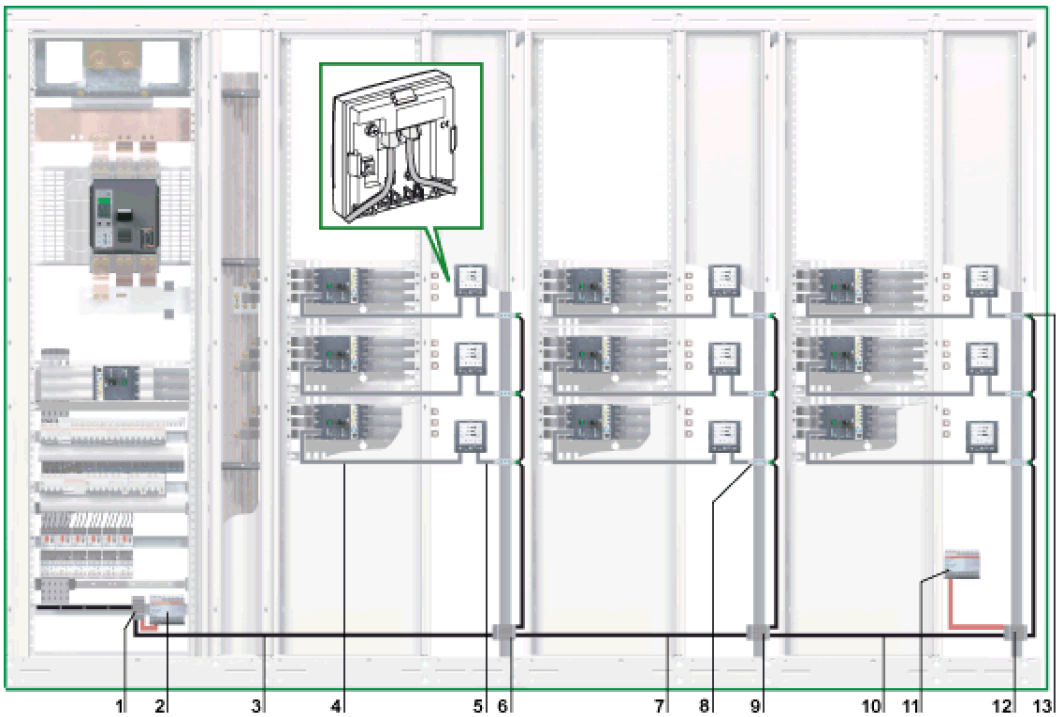
The table below summarizes the maximum Modbus cable lengths for the tap-linked distributed Modbus architecture with a single power supply segment. The Modbus cable under consideration is described in *Connection of Modbus Communication Interface Modules, page 35*.

24 V DC Rating	L0 (in 0.75 mm^2 Wires)	L1	L2	Sum of the L2s (for all Tap Links)
1 A	5 m	35 m	10 m	40 m
3 A	3 m	10 m	5 m	40 m

Case of Several Power Supply Segments

When several 24 V DC power supplies are needed (see *Segmented Power Supply, page 33*), then several power supply segments are used along the Modbus cable.

The figure below shows a tap-linked distributed Modbus architecture with two power supply segments:



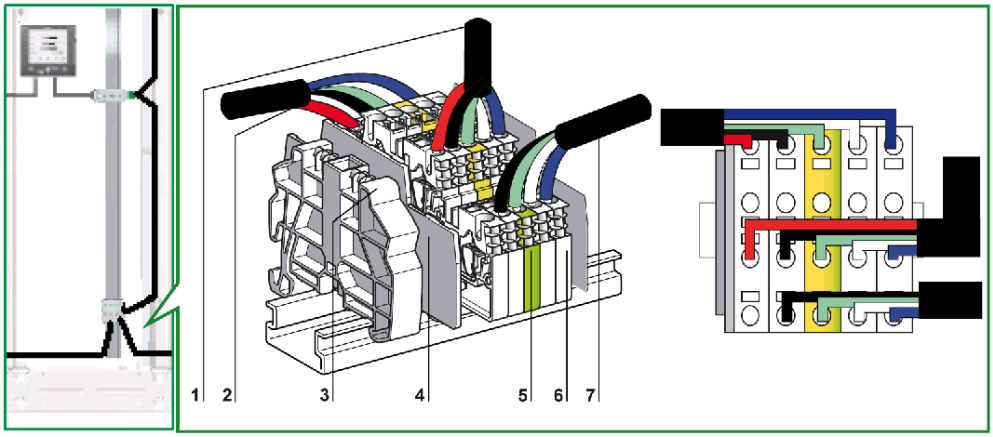
1 Shunt terminal block on the incoming supply
2 24 V DC power supply
2 Modbus cable running to the first column
4 NSX cord
5 ULP cable
6 Shunt terminal block on the incomer of the first column
7 Modbus cable running to the second column
8 Modbus communication interface module
9 Shunt terminal block on the incomer of the second column
10 Modbus cable running to the third column
11 Insertion of a new 24 V DC power supply unit
12 Shunt terminal block on the incomer of the third column
13 Modbus terminator

Shunt Terminal Block on the Incomer of the Second Column

The shunt terminal block on the incomer of the second column is created using four 4-channel spring terminal blocks and one protective ground terminal block offering grounding of the Modbus cable shielding by connection to the DIN rail.

For the shunt terminal block part numbers, see *Shunt Terminal Block on the Incoming Supply, page 58*.

The figure below shows the shunt terminal block on the incomer of the second column in detail:



1 Modbus cable rising up the second column
2 Modbus cable coming from the first column
3 Snap-in plastic end stop
4 End cover
5 Protective ground terminal block
6 Spring terminal block
7 Modbus cable running to the third column

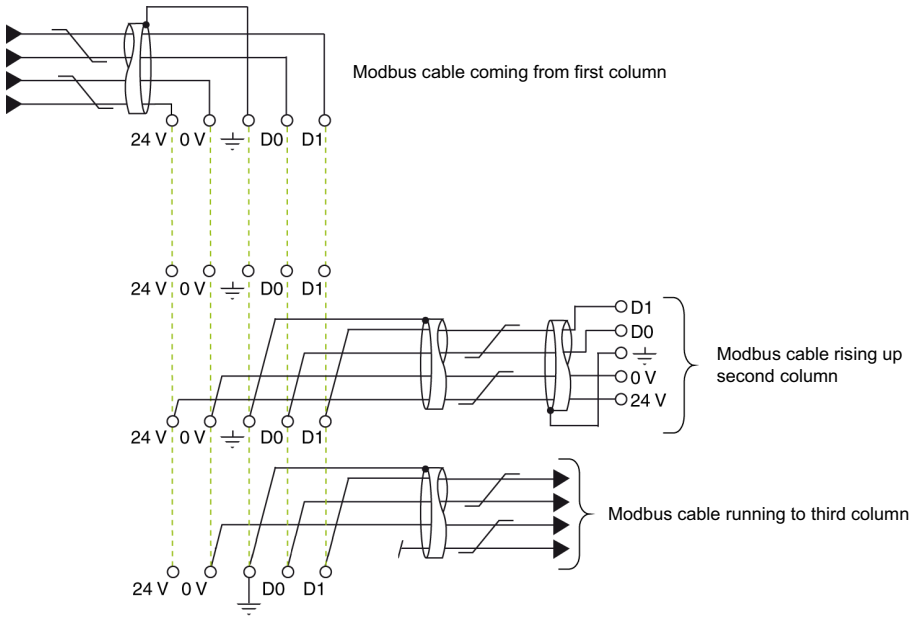
It is possible to create shunt terminal blocks using plug-in terminal blocks to make it easier to transport the switchboard. For more information, refer to *Plug-in Shunt Terminal Block, page 65*.

Modbus Cable Connection

- The Modbus cable coming from the shunt terminal block on the incomer of the first column ensures continuity of the Modbus signal (D0, D1, and 0 V) and the 24 V DC power supply for the second column.
- The Modbus cable running to the third column ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected since the power supply for the third column is connected separately.

Wiring Diagram of Shunt Terminal Block on the Incomer of the Second Column

The wiring diagram below shows the connections for the shunt terminal block on the incomer of the second column in detail:

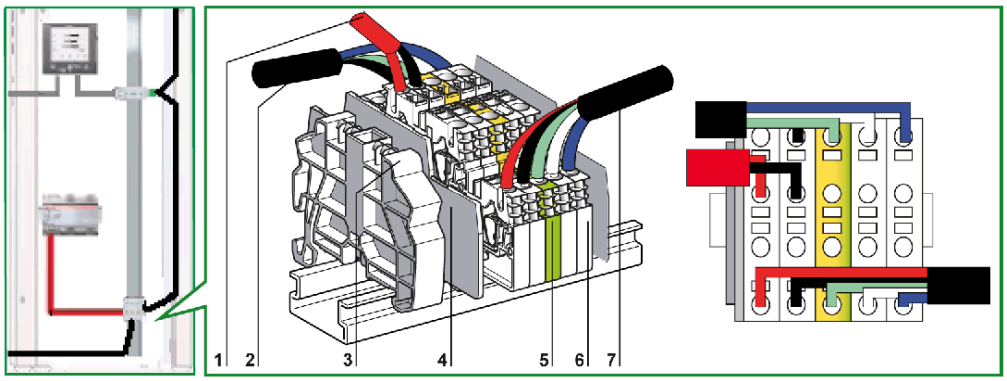


Shunt Terminal Block on the Incomer of the Third Column

The shunt terminal block on the incomer of the third column can be used to connect a new 24 V DC power supply to power the IMUs in the third column.

The shunt terminal block is created using four 4-channel spring terminal blocks and one protective ground terminal block offering grounding of the Modbus cable shielding by connection to the DIN rail.

The figure below shows the shunt terminal block on the incomer of the third column in detail:



1 24 V DC power supply
2 Modbus cable coming from the shunt terminal block on the incomer of the second column
3 Snap-in plastic end stop
4 End cover
5 Protective ground terminal block
6 Spring terminal block
7 Modbus cable rising up the third column

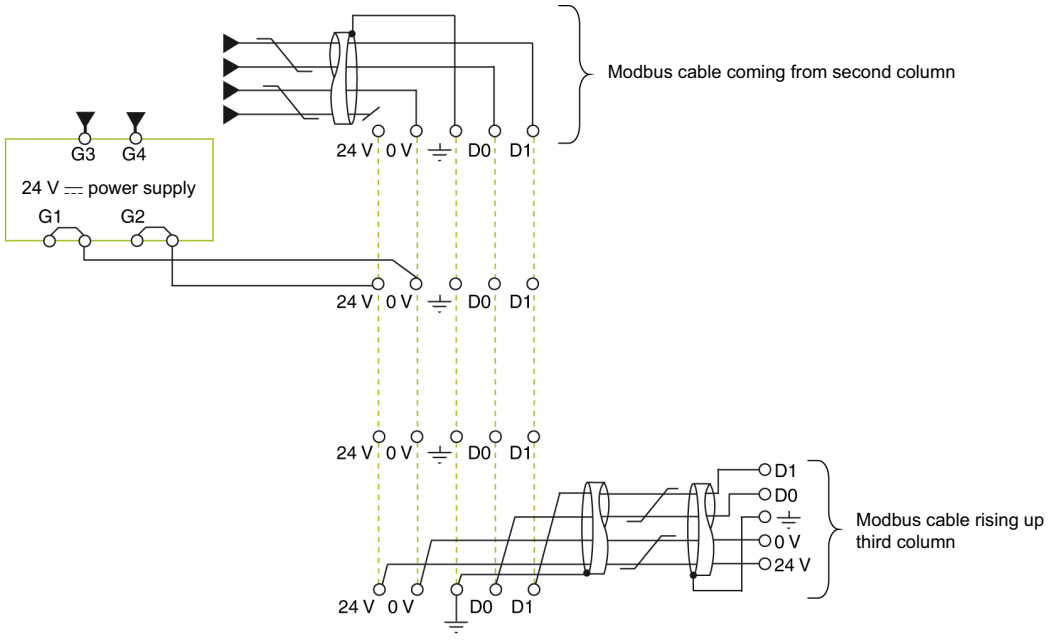
It is possible to create shunt terminal blocks using plug-in terminal blocks to make it easier to transport the switchboard. For more information, refer to *Plug-in Shunt Terminal Block, page 65*.

Modbus Cable Connection

- The Modbus cable coming from the shunt terminal block on the incomer of the second column ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected since the power supply for the third column is connected separately.
- The Modbus cable rising up the third column ensures continuity of the Modbus signal (D0, D1, and 0 V) and the 24 V DC power supply for the third column.

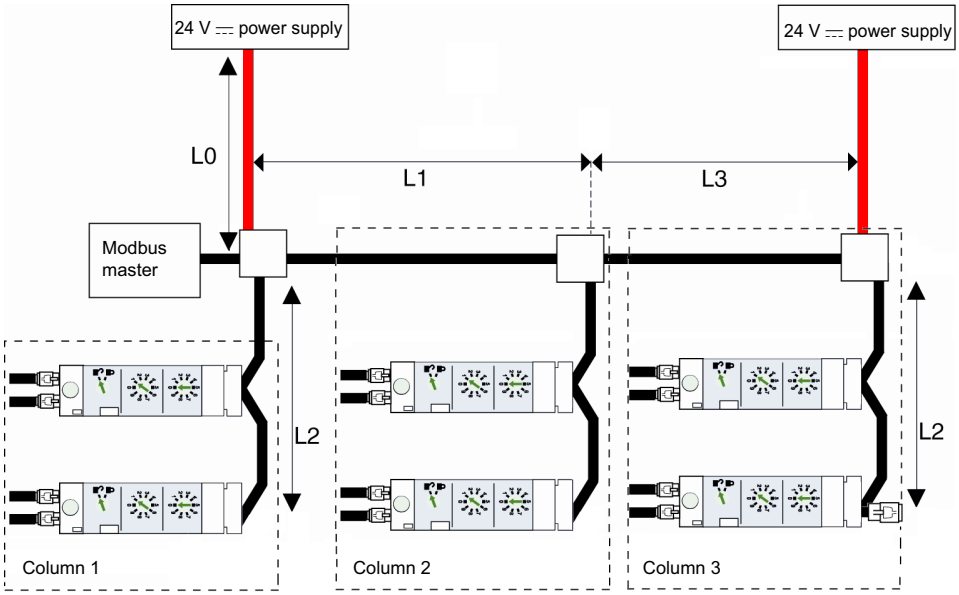
Wiring Diagram of Shunt Terminal Block on the Incomer of the Third Column

The wiring diagram below shows the connections for the shunt terminal block on the incomer of the third column in detail:



Modbus Cable Lengths for Several Power Supply Segments

The figure below shows the Modbus cable lengths for a daisy-chained distributed Modbus architecture with several power supply segments in detail:



Modbus cable L3 ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected since the power supply is connected separately on the shunt terminal block on the incomer of the third column.

The table below summarizes the maximum Modbus cable lengths for the tap-linked distributed Modbus architecture with several power supply segments. The Modbus cable under consideration is described in *Connection of Modbus Communication Interface Modules, page 35*.

24 V DC Rating	L0 (in 0.75 mm^2 Wires)	L1	L2	Sum of the L2s (for all Tap Links)	Sum of the L1s, L2s, and L3s (Total Length)
1 A	5 m	35 m	10 m	40 m	500 m
3 A	3 m	10 m	5 m	40 m	500 m

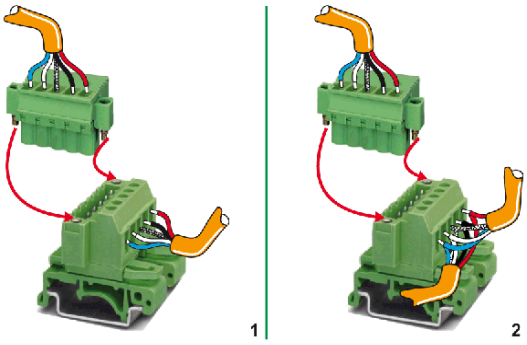
NOTE: The maximum number of power supply segments is three segments for a single installation, with a maximum rating of 3 A for each power supply segment (see *Segmented Power Supply, page 33*).

Plug-in Shunt Terminal Block

The part numbers below are given to illustrate how to create a plug-in shunt terminal block to make it easier to transport the switchboard.

Component	Nominal Cross-Section	Phoenix Contact Part Number
Pluggable connector MSTB 2.5/5-STF-5.08	2.5 mm^2	1778014
Base unit on DIN rail UMSTBVK 2.5/5-GF-5.08	2.5 mm^2	1787953
Optional cable cover for pluggable connector KGG - MSTB 2.5/5	–	1803895

The figure below shows two examples of plug-in terminal blocks. The order of connection is the same as for the 5-pin connector on the Modbus communication interface module (D1, D0, shielding braid, 0 V, and 24 V):



1 Plug-in terminal block
2 Plug-in terminal block used as a tee (two Modbus cables on the fixed base and one Modbus cable on the pluggable connector)

ULP System Modules

3

Aim of this Chapter

This chapter describes the ULP system modules and the RSU software.

NOTE: A summary of the technical characteristics of ULP modules is provided in the appendices *(see page 132)*.

What's in this Chapter?

This chapter contains the following sections:

Section	Topic	Page
3.1	Modbus Communication Interface Module	68
3.2	Front Display Module FDM121	81
3.3	Maintenance Module	107
3.4	RSU Software	121

3.1 Modbus Communication Interface Module

Aim of this Section

This section describes the Modbus communication interface module.

What's in this Section?

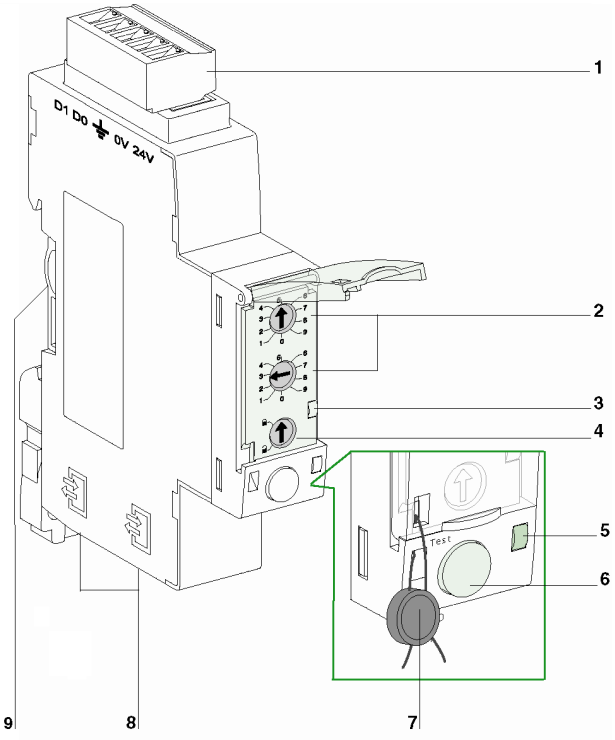
This section contains the following topics:

Topic	Page
Presentation of the Modbus Communication Interface Module	69
Installing the Modbus Communication Interface Module	71
Operation of the Modbus Communication Interface Module	73
2-wire RS 485 isolated repeater Module	76

Presentation of the Modbus Communication Interface Module

Functions

The Modbus communication interface module is a communication interface which allows intelligent modular units (IMUs) to communicate using the Modbus protocol. Each communicating IMU has its own Modbus interface module and a Modbus address chosen by the user.



1 Modbus 5-pin connector and 24 V DC power supply
2 Modbus address switches
3 Modbus traffic LED
4 Modbus locking pad
5 ULP activity LED
6 Test button
7 Mechanical lock
8 ULP RJ45 connectors
9 Stacking accessory connection

Characteristics

The Modbus communication interface module has the following characteristics:

Characteristic	Value
Dimensions	18 x 72 x 96 mm
Degree of protection of the installed module	• Part projecting beyond the escutcheon: IP4x • Other module parts: IP3x • Connectors: IP2x
Operating temperature	-25...+70°C
Power supply voltage	24 VDC -20%/+10% (19.2...26.4 VDC)
Consumption	• Typical: 21 mA/24 VDC at 20°C • Maximum: 30 mA/19.2 VDC at 60°C

Conformance to Standards

Certification	Characteristics
CE	IEC/EN 60947-1
UL	UL 508 - Industrial Control Equipment
CSA	No. 142-M1987 - Process Control Equipment • CAN/CSA C22.2 No. 0-M91 - General requirements - Canadian Electrical Code Part • CAN/CSA C22.2 No. 14-05 - Industrial Control Equipment

Part Numbers

Product	Part Number
Modbus communication interface module	TRV00210
Stacking accessories (if there is more than one Modbus interface module, supplied in sets of 10)	TRV00217
ULP terminator	TRV00880
2-wire RS 485 isolated repeater module (Modbus network outside the switchboard)	TRV00211

Installing the Modbus Communication Interface Module

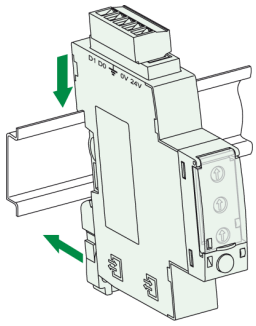
Mounting

There are two possible mounting configurations for the Modbus communication interface module:

- Direct mounting on DIN rail
- Mounting on the stacking accessory mounted on a DIN rail

Direct Mounting on DIN Rail

The figure below shows the direct mounting of the Modbus communication interface module on a DIN rail:

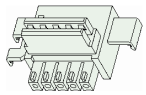


Direct mounting on a DIN rail is used in the case of distributed architectures (see *Daisy-Chained Distributed Modbus Architecture, page 51* and *Tap-Linked Distributed Modbus Architecture, page 57*).

Stacking Accessory

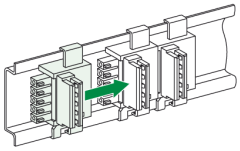
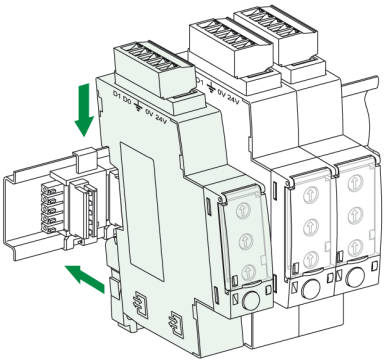
Where there are several communicating intelligent modular interfaces (IMUs) in a switchboard column, the Modbus communication interface modules in the column can be grouped in blocks on the column incomer (see *Centralized Modbus Architecture, page 44*).

The stacking accessory can be used for quick connection by simply snapping in the Modbus communication interface modules, thus providing the Modbus link and the 24 VDC power supply between all the adjacent Modbus communication interface modules, without any additional wiring.



Mounting on the Stacking Accessory

The procedure for mounting the Modbus communication interface module on the stacking accessory is as follows:

Step	Action
1	Clip the stacking accessories onto the DIN rail (1 stacking accessory for each Modbus communication interface module) and snap them together: 
2	Mount the Modbus communication interface module on the DIN rail and snap it onto its stacking accessory: 

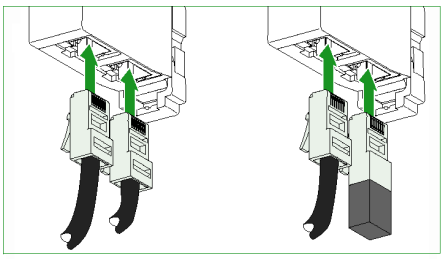
NOTE: Do not clip more than 12 Modbus communication interface modules together with the stacking accessory.

Modbus Network Outside the Switchboard

As the Modbus communication interface module is non-isolated, a 2-wire RS 485 isolated repeater *(see page 76)* module has to be inserted between the Modbus network inside the switchboard and the Modbus network outside the switchboard.

ULP Connection

The two ULP RJ45 connectors on the Modbus communication interface module are used to connect it to the other ULP modules on the IMU. Both ULP connectors are identical and in parallel, allowing the IMU ULP modules to be connected in any order.



NOTE: When the second ULP connector is not used (Modbus communication interface module at the end of the ULP line), it must be closed with a ULP terminator (ref. TRV00880).

5-pin Screw Type Connector (Modbus Connection and 24 VDC Power Supply)

The 5-pin connector is a screw connection block that is used to power the IMU and connect it to the Modbus network. Connecting the Modbus cable to the 5-pin connector is described in *Connection to the Modbus Communication Interface Module, page 36*.

Operation of the Modbus Communication Interface Module

Introduction

The user can configure the Modbus communication interface module directly on its front panel or with the RSU software.

The Modbus communication interface module can be used to:

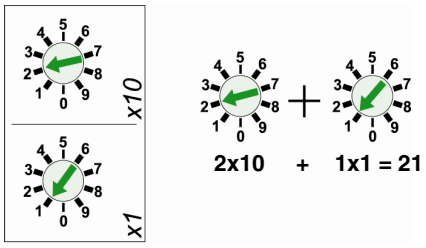
- Assign a Modbus address to the Modbus communication interface module and its associated intelligent modular unit (IMU)
- Enable/disable remote control commands
- Test the ULP connection

Modbus Address

The address switches assign a Modbus slave address to the Modbus communication interface module and its associated IMU.

The user defines the Modbus address in the range 1...99. The first address switch corresponds to the tens and the second address switch corresponds to the units.

The figure below shows the address switch configuration for address 21:



The Modbus communication interface module is factory-set with address 99.

Address 00 is reserved for Modbus broadcasting.

If the address switches are set to address 00, no Modbus communication is accepted by the Modbus communication interface module.

The user can modify the address at any time. The change of address takes effect 5 seconds after the modification.

Modbus Traffic LED

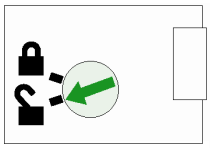
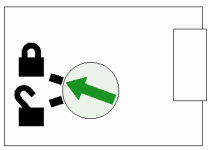
The yellow Modbus traffic LED describes the Modbus communication activity:

LED Status	Meaning
Blinking	Transmission/reception of a Modbus frame by the Modbus communication interface module
Steady ON	Address 00 assigned to the Modbus communication interface module

For more information about Modbus communication between the Modbus communication interface module and the Compact NSX circuit breaker, refer to *Modbus Compact NSX - User manual*.

Modbus Locking Pad

The Modbus locking pad on the front panel of the Modbus communication interface module enables or disables remote control commands and modification of the IMU module parameters.

Locking Pad Status	Meaning
	Remote control commands and parameter modifications are enabled.
	Remote control commands and parameter modifications are disabled. In this case, the only remote control commands that are enabled are the get time and set time commands on the IMU ULP modules. For more information about these commands, refer to *Modbus Compact NSX - User manual*.

ULP Activity LED

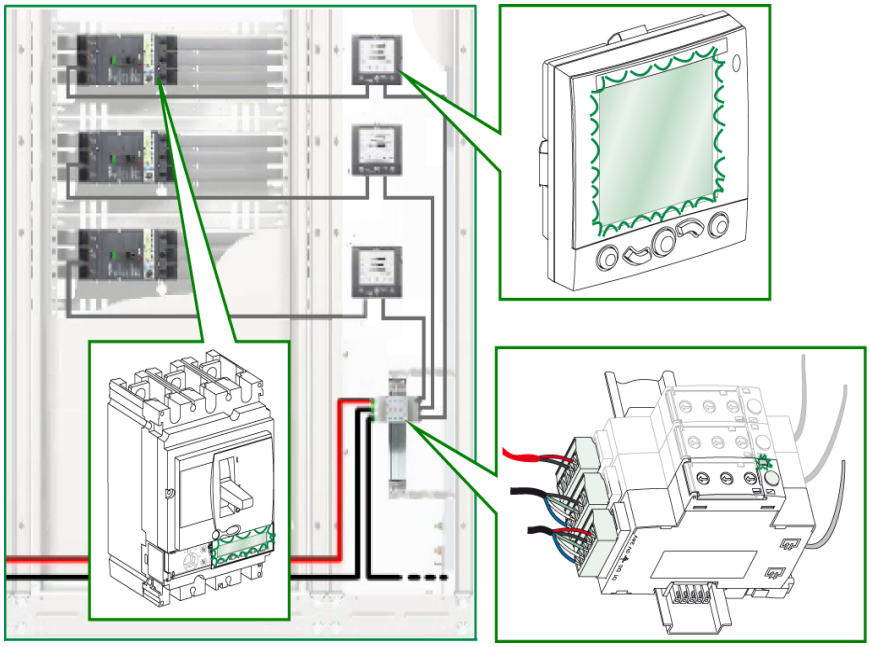
The yellow ULP activity LED indicates the status of the connection between the ULP modules on the IMU:

LED Status	Meaning
ON: 50 ms/OFF: 950 ms	Nominal operation (test button not pressed): The Modbus communication interface module is correctly connected to the IMU.
ON: 250 ms/OFF: 250 ms	Prohibited configuration: 2 identical modules are detected in the same IMU. 2 identical modules cannot form part of the same IMU.
ON: 500 ms/OFF: 500 ms	Degraded mode (EEPROM off)
ON: 1000 ms/OFF: 1000 ms	Test mode
Steady ON	The Modbus communication interface module is supplied with power but the ULP connection is not working.
Steady OFF	The Modbus communication interface module is not supplied with power.

Test Button

The test button is used to check that there is a good connection between all the ULP modules connected to the Modbus communication interface module.

The figure below shows an IMU consisting of a Modbus communication interface module, a front display module FDM121 and a Compact NSX circuit breaker equipped with a Micrologic trip unit:

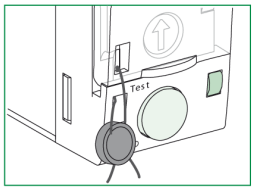


Pressing the test button starts the ULP connection test for 15 seconds. In test mode, the ULP activity LED on the Modbus communication interface module and the backlighting on the front display module FDM121 and Micrologic trip unit flash simultaneously (ON: 1000 ms/OFF: 1000 ms), making it easy to identify the IMU modules in the switchboard.

During the test, all the IMU module functions execute normally.

Mechanical Lock

The mechanical lock prevents access to the address switches and the locking pad on the Modbus communication interface module.



Configuration

The Modbus communication interface module is configured in one of two ways:

- Automatic configuration (Auto-Speed sensing On): When a Modbus master is communicating on the Modbus communication network, the Modbus communication interface module automatically detects the speed and parity of the Modbus connection (default configuration).
- Custom configuration: By deactivating the Auto-Speed sensing option in the Modbus communication interface module configuration window with the RSU (Remote Setting Utility) software, the user can customize the speed and parity of the Modbus connection.

Automatic Configuration

The user defines the Modbus address for the Modbus communication interface module using the 2 address switches. When the Modbus communication interface module is connected to the Modbus network, it automatically detects the connection parameters. The Auto-Speed sensing algorithm automatically tests the possible speeds and parities and detects the speed and parity of the connection.

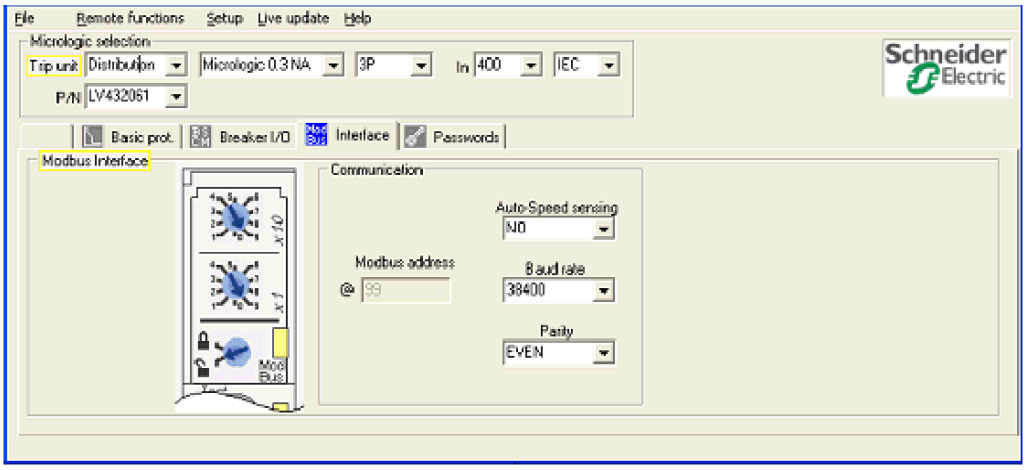
The transmission format is binary with 1 start bit, 8 data bits, 1 stop bit in the case of even or odd parity and 2 stop bits if there is no parity.

Custom Configuration

The user defines the Modbus address for the Modbus communication interface module using the 2 address switches.

The user can customize the communication parameters with the RSU (Remote Setting Utility) software described in *RSU Software, page 121*.

The figure below shows configuration of the Modbus communication interface module with RSU when the Auto-Speed sensing function is deactivated:



- The supported speeds are: 4800, 9600, 19200, and 38400 baud
- The supported parities are: Even, odd and no parity

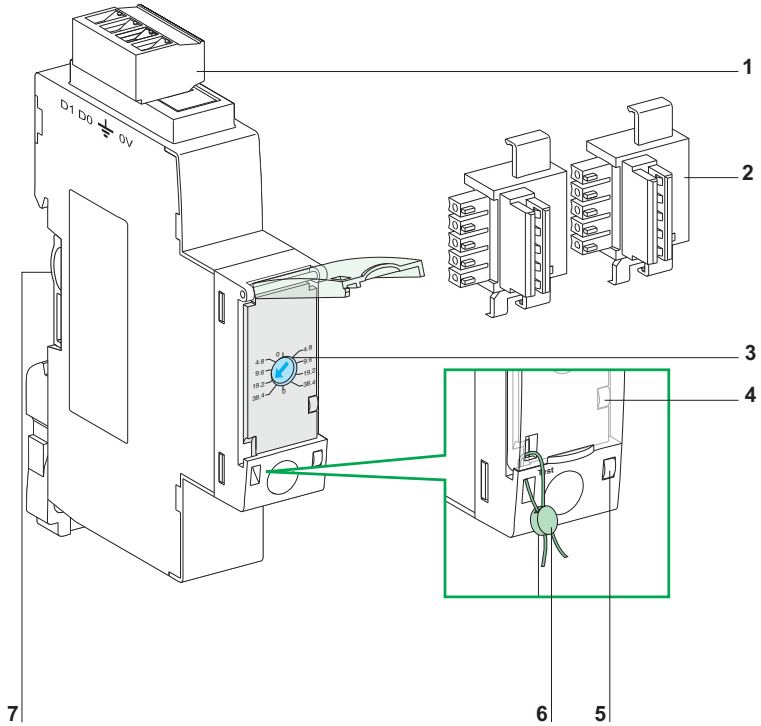
NOTE: The Modbus address and locking pad status cannot be modified with the RSU software.

For more information about the RSU software, refer to *RSU Software, page 121* and the *RSU Online Help*.

2-wire RS 485 isolated repeater Module

Function

The 2-wire RS 485 isolated repeater module electrically isolates a 2-wire RS 485 Modbus network inside the switchboard from a 2-wire RS 485 Modbus network outside the switchboard. This module must be used in this case because the Modbus communication interface module is not isolated.



1 Modbus 4-pin connector
2 2 stacking accessories (supplied with the repeater)
3 Thumbwheel (to set the transmission speed and format)
4 Modbus traffic LED
5 Status LED
6 Mechanical lock with a lead seal
7 Stacking accessory connection

Characteristics

The 2-wire RS 485 isolated repeater module has the following characteristics:

Characteristic	Value
Dimensions	18 x 72 x 96 mm
Degree of protection of the installed module	• Part projecting beyond the escutcheon: IP4x • Other module parts: IP3x • Connectors: IP2x
Operating temperature	-25...+70°C
Power supply voltage	24 VDC -20%/+10% (19.2...26.4 VDC)
Consumption	• Typical: 15 mA/24 V DC at 20°C • Maximum: 19 mA/19.2 to 24 V DC at 60°C

Conformance to Standards

Certification	Characteristics
CE	IEC/EN 60947-1
UL	UL 508 - Industrial Control Equipment
CSA	No. 142-M1987 - Process Control Equipment • CAN/CSA C22.2 No. 0-M91 - General requirements - Canadian Electrical Code Part • CAN/CSA C22.2 No. 14-05 - Industrial Control Equipment

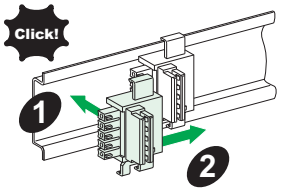
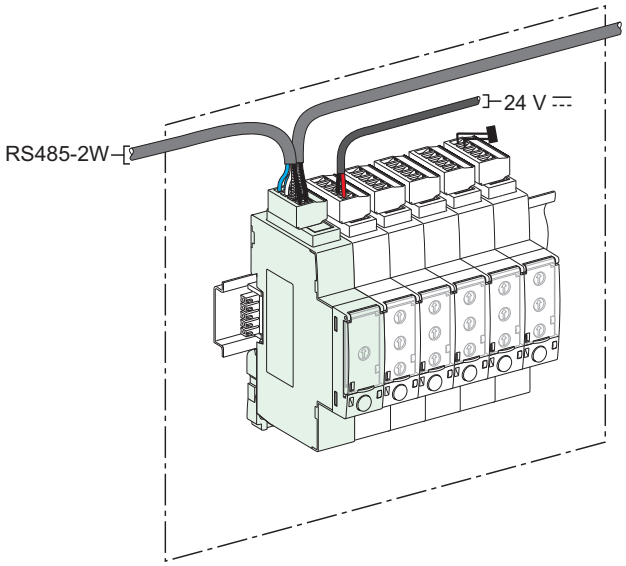
Part Numbers

Product	Part Number
2-wire RS 485 isolated repeater module	TRV00211

Centralized Mounting

Centralized mounting of the 2-wire RS 485 isolated repeater module facilitates the implementation of optimized architectures.

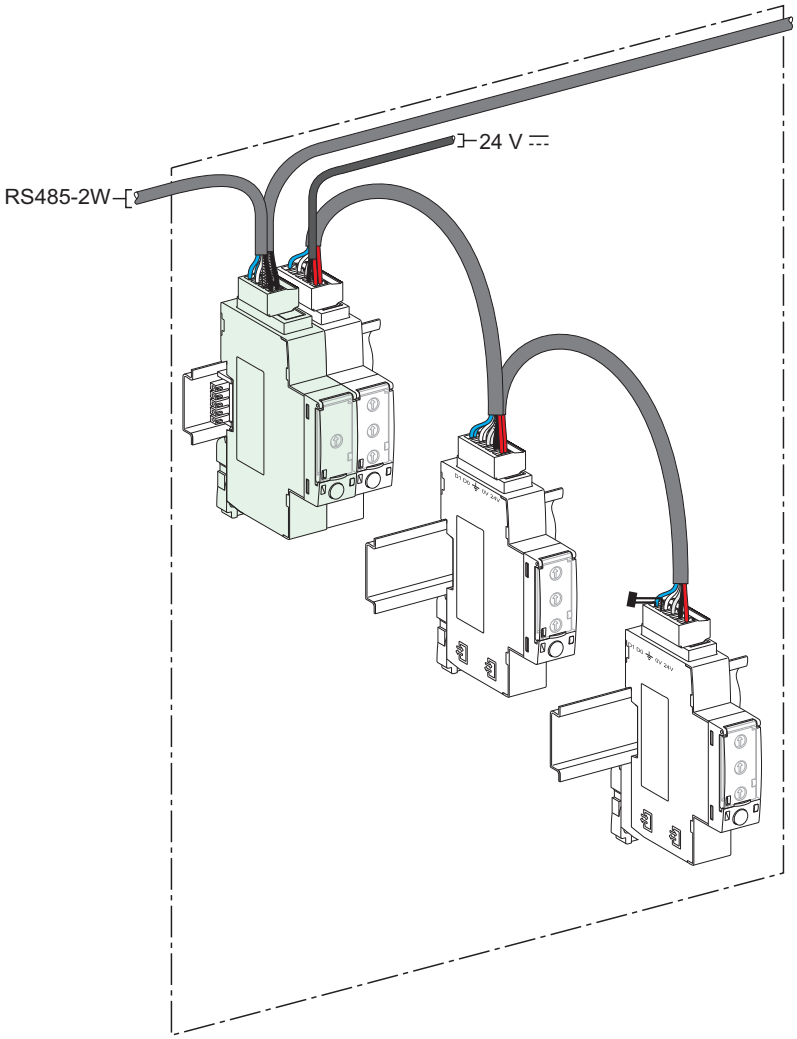
To mount the 2-wire RS 485 isolated repeater module in a centralized architecture, proceed as follows:

Step	Action
1	Clip the 2 stacking accessories supplied to the 2-wire RS 485 isolated repeater module in order to electrically isolate the repeater and the first Modbus communication interface module. 
2	Connect the auxiliary power supply on the first Modbus communication interface module (TRV00210).
3	Connect the Modbus network on the 2-wire RS 485 isolated repeater module.  **NOTE:** • If you are using more than one Modbus communication interface module, remember to add the stacking accessories, part number TRV00217. • Do not clip more than 12 Modbus communication interface modules to the stacking accessory connected to the 2-wire RS 485 isolated repeater module. • For detailed information about line termination, refer to the section titled *Modbus Connection Linking Two Switchboards (see page 40)*.

Distributed Mounting

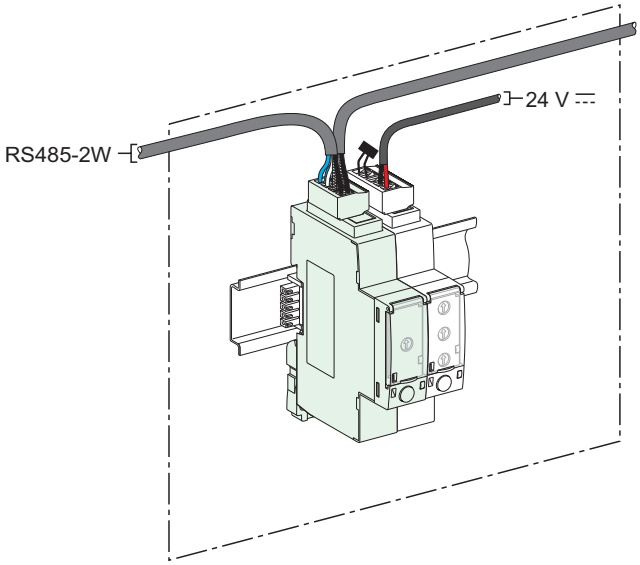
Distributed mounting of the 2-wire RS 485 isolated repeater module enables Modbus communication interface modules within the switchboard to be distributed while ensuring electrical isolation.

To mount the 2-wire RS 485 isolated repeater module in a distributed architecture, proceed as follows:

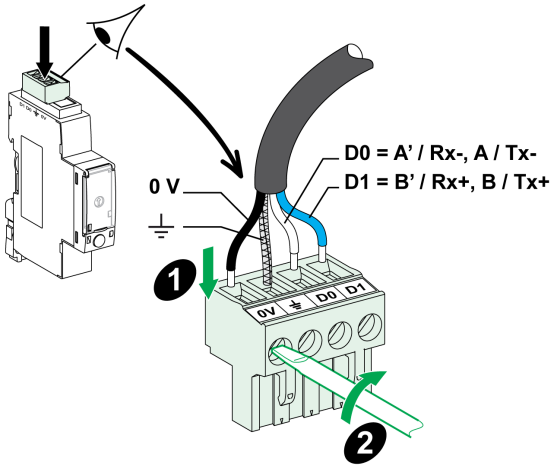
Step	Action
1 to 3	Carry out steps 1 to 3 described above for centralized mounting *(see page 77)*.
4	Then continue with mounting as follows:  **NOTE:** ● If you are using more than one Modbus communication interface module, remember to add the stacking accessories, part number TRV00217. ● Do not clip more than 12 Modbus communication interface modules to the stacking accessory connected to the 2-wire RS 485 isolated repeater module. ● Do not forget to add the Modbus termination accessory (part number VW3A8306DRC). ● For detailed information about integration in a 2-wire Modbus RS 485 network, refer to the section titled *Modbus Connection Linking Two Switchboards (see page 40)*: Cable segment length, Modbus terminator, etc.

Connection

The 24 V DC auxiliary power supply must be connected on the 5-pin connector of the first Modbus communication interface module in order to ensure electrical isolation from the Modbus RS 485 network inside the switchboard.



The Modbus RS 485 network must be connected on the 4-pin connector of the isolated repeater module.

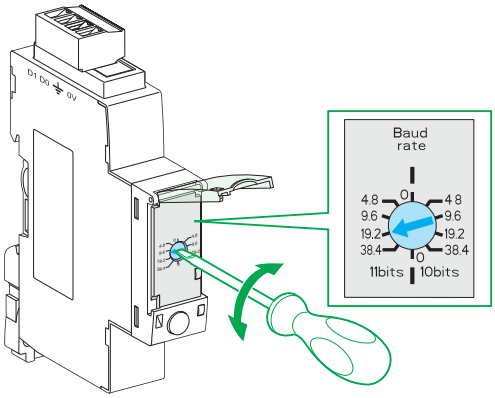


2-wire RS 485 isolated repeater Parameter Settings

The parameter settings for the 2-wire RS 485 isolated repeater module involve adjusting:

- The transmission speed
- The transmission format for data on the serial link

The transmission speed and format can be adjusted at the same time using a thumbwheel. The following figure shows the 2-wire RS 485 isolated repeater module with its factory-set parameters.



Thumbwheel Position	Number of Data Bits	Data Format	Transmission Speed (kBaud)
Right	10 bits	1 start bit, 8 data bits, 1 stop bit	4,8 9,6 19.2 (by default) 38,4
Left	11 bits (by default)	1 start bit, 8 data bits, 2 stop bits or 1 start bit, 8 data bits, 1 parity bit, 1 stop bit	

NOTE:

When the thumbwheel is in position 0 (central):

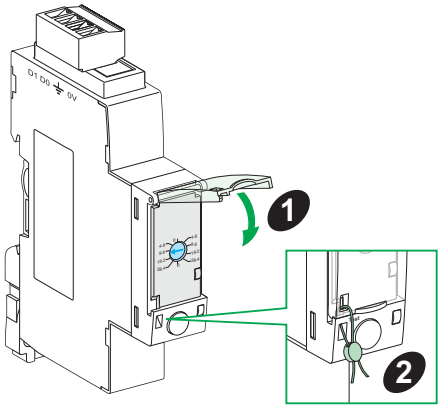
- The 2-wire RS 485 isolated repeater module has an error (status LED steady yellow ON).
- Modbus communication is not possible.

Meaning of the LEDs

LED Name	LED Status	Meaning
Modbus	Flashing yellow	Transmission/reception of a Modbus frame by the 2-wire RS 485 isolated repeater module
Status	Green steady ON	Module ready
	Yellow steady ON	Module error The thumbwheel is in position 0 (central).

Mechanical Lock

The mechanical lock (with a lead seal) prevents access to the thumbwheel on the 2-wire RS 485 isolated repeater module.



3.2 Front Display Module FDM121

Aim of this Section

This section describes the front display module FDM121.

What's in this Section?

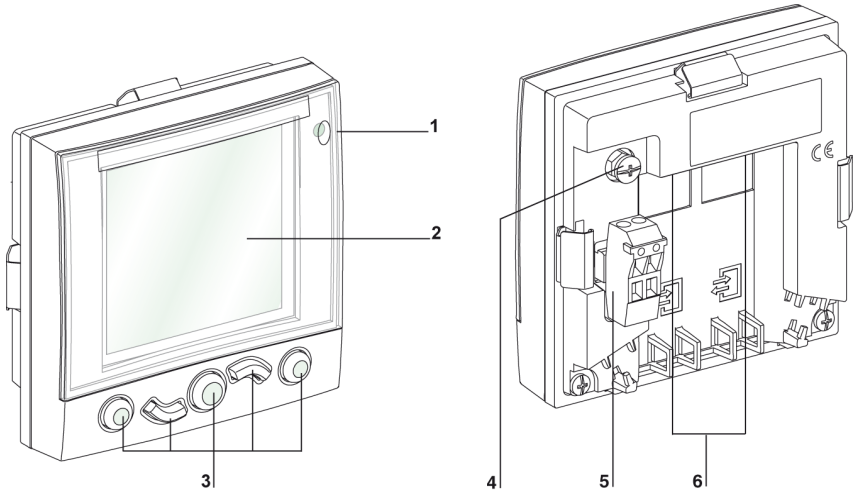
This section contains the following topics:

Topic	Page
Presentation of the Front Display Module FDM121	82
Installing the Front Display Module FDM121	83
Operation of the Front Display Module FDM121	89
Main Menu	92
Quick View Menu	93
Metering Menu	95
Control Menu	97
Alarms Menu	99
Services Menu	102

Presentation of the Front Display Module FDM121

Functions

The front display module FDM121 displays the measurements, alarms and operating assistance data from the intelligent modular unit (IMU).



1 Alarm Indicator LED
2 LCD screen
3 Navigation keys
4 Functional ground
5 24 VDC power supply terminal block
6 ULP RJ45 connectors

Characteristics

The front display module FDM121 has the following characteristics:

Characteristic	Value
Dimensions	• Without power supply terminal block: 96 x 96 x 33.1 mm • With power supply terminal block: 96 x 96 x 43.2 mm
Degree of protection of the installed module (on the front face with a door cut-out)	• IP53 conforming to standard IEC 60529 • IK 05 conforming to standard IEC 60068-2-75
Screen	128 x 128 pixels
Viewing angle	• Horizontal: +/- 30° • Vertical: +/- 60°
Operating temperature	-10...+55°C (on the front panel)
Power supply voltage	24 VDC -20%/+10% (19.2...26.4 VDC)
Consumption	• Typical: 21 mA/24 VDC at 20°C • Maximum: 30 mA/19.2 VDC at 55°C

Conformance to Standards

Certification	Characteristics
CE	IEC/EN 60947-1
UL	UL 508 - Industrial Control Equipment
CSA	No. 142-M1987 - Process Control Equipment • CAN/CSA C22.2 No. 0-M91 - General requirements - Canadian Electrical Code Part • CAN/CSA C22.2 No. 14-05 - Industrial Control Equipment

Part Numbers

Product	Part Number
Front display module FDM121	TRV00121
Surface-mounting accessory	TRV00128
ULP terminator	TRV00880

Installing the Front Display Module FDM121

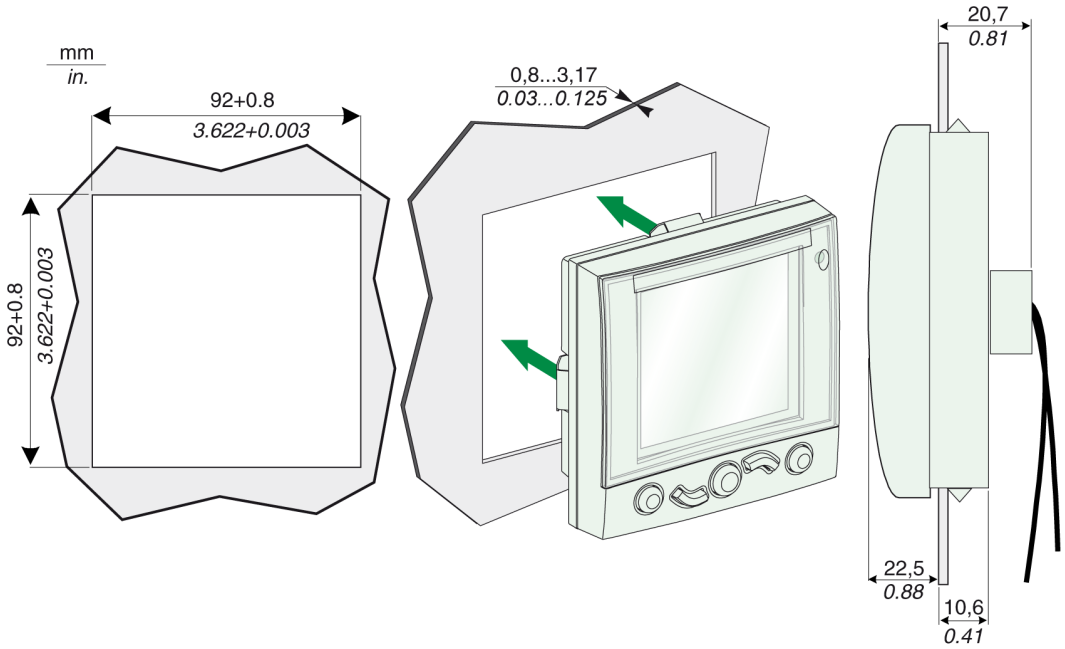
Mounting

There are two possible mounting configurations for the front display module FDM121:

- Mounting in a door cut-out with clip fixing
- Retrofit mounting through drill holes and fixing with a surface-mounting accessory

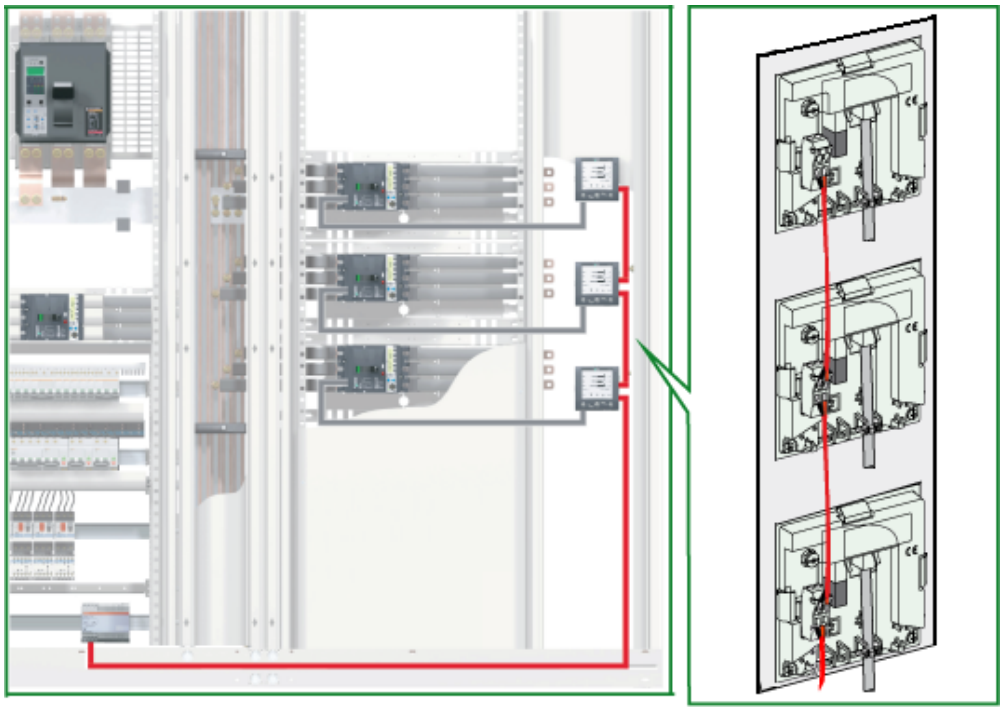
Door Cut-Out Mounting

The front display module FDM121 is mounted by cutting a standard 92 x 92 mm (3.622 x 3.622 in.) cut-out on the door and fixing it in place by clips:



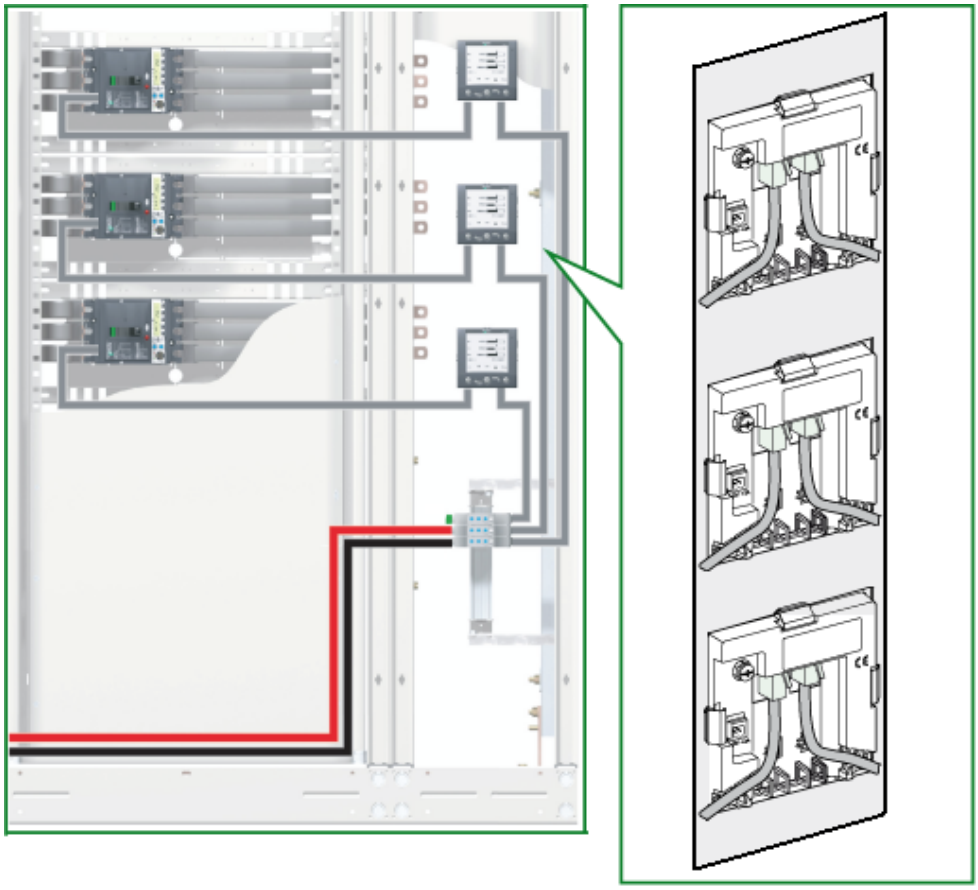
Door Cut-Out Mounting for Standalone Architecture

The figure below shows an example of mounting the front display module FDM121 in door cut-outs in the case of a standalone architecture. The intelligent modular units (IMUs) are powered by the front display module FDM121 power supply terminal block:



Door Cut-Out Mounting for Communicating Architecture

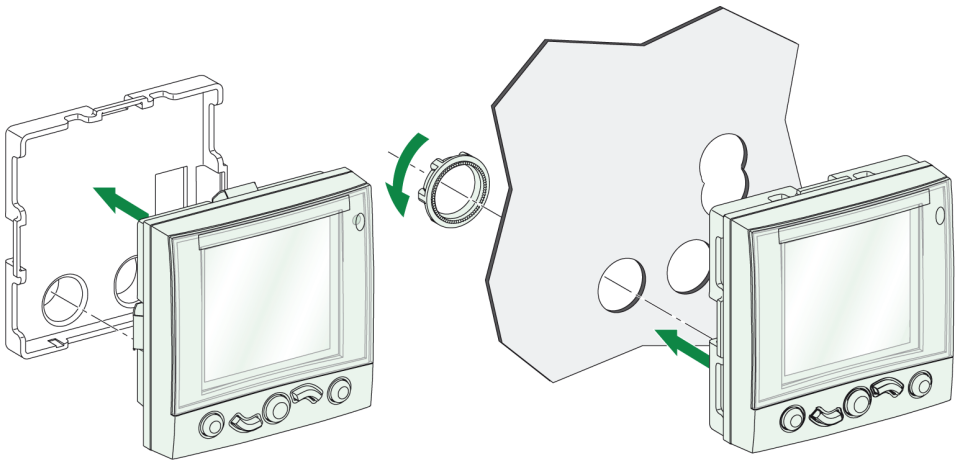
The figure below shows an example of mounting the front display module FDM121 in door cut-outs in the case of a centralized Modbus architecture. In this case, the IMUs are powered via the Modbus cable or by connecting a 24 VDC power supply to the Modbus communication interface module. The front display module FDM121 power supply terminal block can therefore be removed.



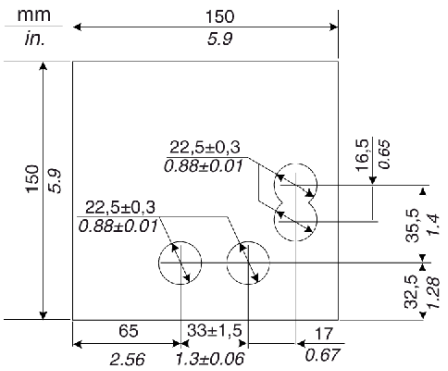
Drill Hole Mounting

The front display module FDM121 is mounted by drilling 2 holes 22.5 mm in diameter and fixing it in place using a surface-mounting accessory and a locking nut.

A third cut-out with 2 drill holes 22.5 mm (0.88 in.) in diameter is needed for the front display module FDM121 power supply terminal block when this is used to power the IMUs.

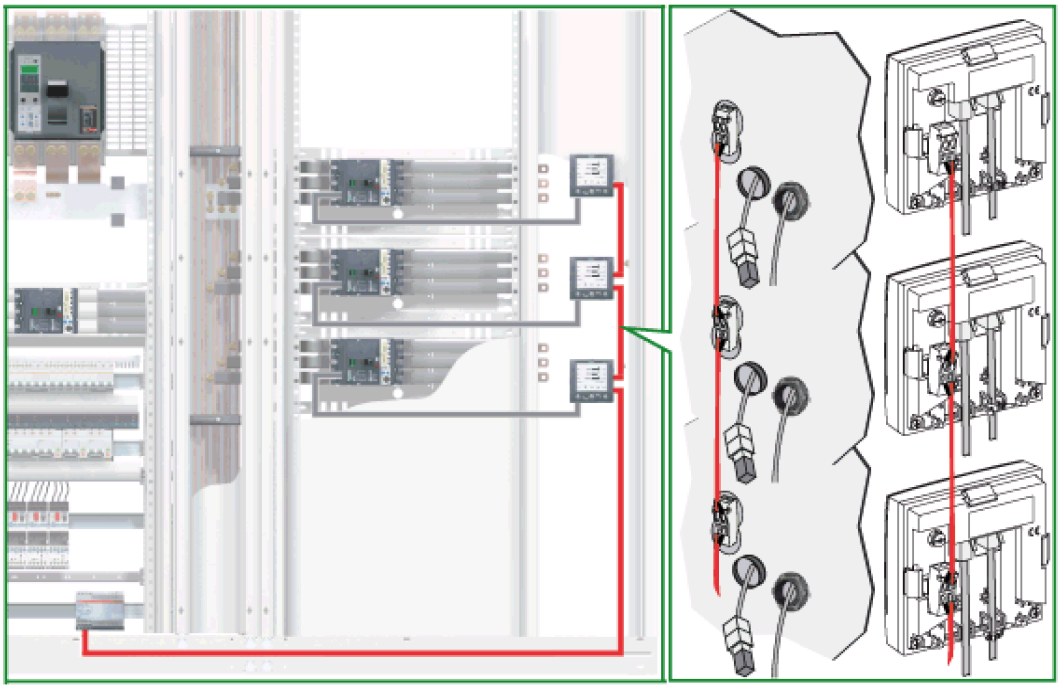


The figure below shows the drilling dimensions:



Drill Hole Mounting for Standalone Architecture

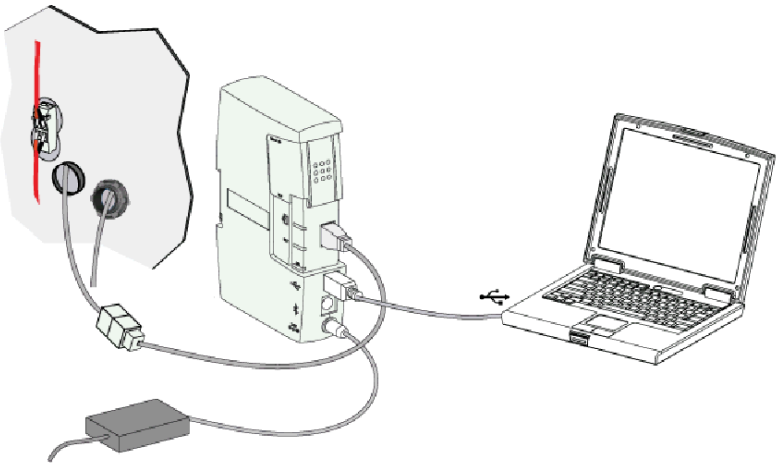
The cut-out for the front display module FDM121 power supply terminal block is particularly necessary for retrofit mounting for standalone modular units, since they are powered by this terminal block.



Drill Hole Mounting and ULP Termination

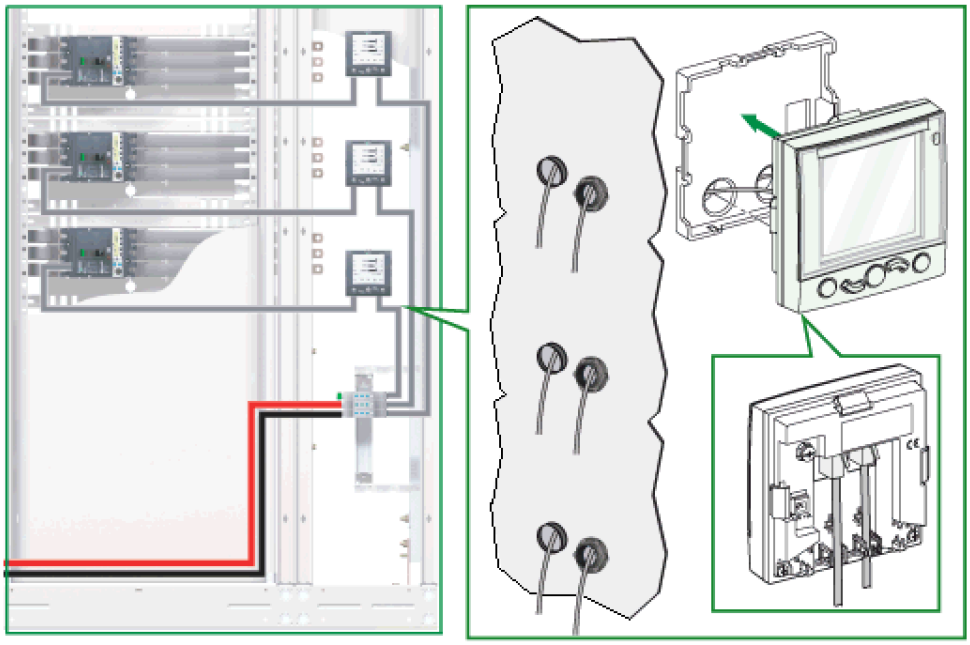
In the case of mounting through drill holes on the door when the second ULP connector on the front display module FDM121 is not being used (see previous figure), a ULP cable and an RJ45 female/female connector closed with a ULP terminator are used (ref. TRV00880).

This makes it easier to access the ULP terminator, especially when connecting the maintenance module (see *Maintenance Module ULP Connection, page 113*):



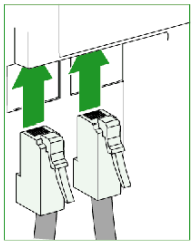
Drill Hole Mounting for Communicating Architecture

The figure below shows an example of mounting the front display module FDM121 through drill holes in the case of a centralized Modbus architecture. In this case, the IMUs are powered by the Modbus cable. The front display module FDM121 power supply terminal block can therefore be removed, and only 2 x 22.5 mm (0.88 in.) diameter holes are needed.



ULP Connection

The two ULP RJ45 connectors on the front display module FDM121 are used to connect it to the ULP modules on the IMU. Both ULP connectors are identical and in parallel, allowing the IMU ULP modules to be connected in any order.

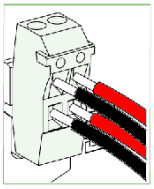


NOTE: When the second ULP connector is not used (front display module FDM121 at the end of the ULP line), it must be closed with a ULP terminator (ref. TRV00880).

24 VDC Power Supply

The front display module FDM121 is powered either via the ULP cables or by direct connection of the power supply to the front display module FDM121 power supply terminal block:

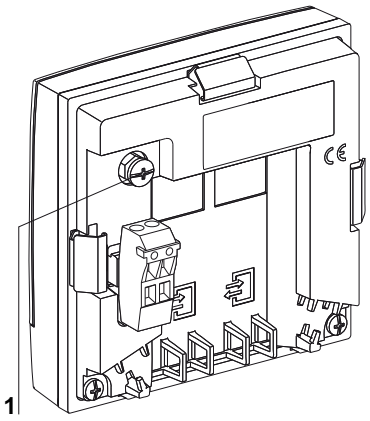
- In the case of a communicating architecture, the 24 VDC power supply is connected to the 5-pin connector on the Modbus communication interface module. The other modules on the IMU are powered by the Modbus communication interface module and the ULP cables. The front display module FDM121 power supply terminal block can be removed to reduce the dimensions.
- In the case of a standalone architecture, the IMUs are powered by the front display module FDM121 power supply terminal block.

Power Supply Terminal Block	Wire	Color	Description	Cross-Section	Stripped Length
		Black	0 V	0.2...1.5 mm^2 (24...16 AWG)	7 mm (0.28 in.)
		Red	24 V	0.2...1.5 mm^2 (24...16 AWG)	7 mm (0.28 in.)

The 24 VDC supply terminal block has 2 points per terminal to simplify, if necessary, distribution of the power supply to other front display module FDM121s in the switchboard (see *Door Cut-Out Mounting for Standalone Architecture, page 83*).

Functional Ground

In an environment with a high level of electromagnetic disturbance, it is advisable to connect the front display module FDM121 functional ground to the local machine ground in the switchboard using a grounding strip.

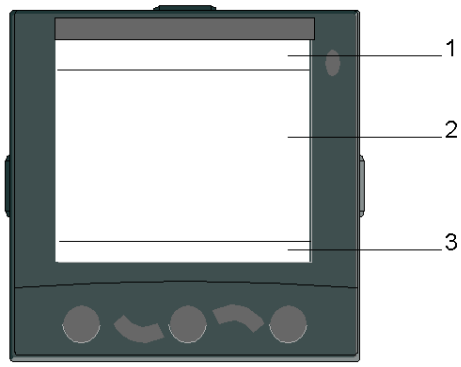


1 Functional ground

Operation of the Front Display Module FDM121

Screen

The screen displays the information needed to operate the ULP modules:

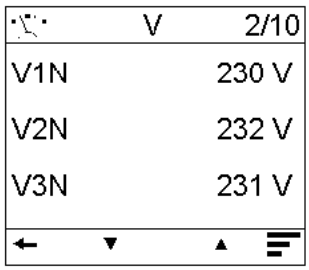


1 Identification zone
2 Information zone
3 Navigation zone

The display has three zones:

- The identification zone identifies the current screen (screen title) and notifies the user when an alarm trips.
- The information zone displays specific data on the screen (measurements, alarms, settings, etc.).
- The navigation zone indicates which navigation options are available using the keys, depending on the menu displayed.

The table below shows an example of the display:

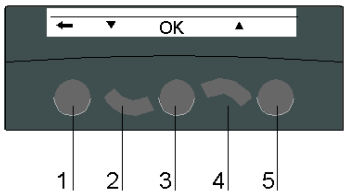
Example	Description
	Identification zone ● The icon indicates that you are in the **Metering** menu. ● The measurements displayed are voltages. ● The **V L-L V L-N** sub-menu in the **Metering** menu consists of 10 screens. The **V** screen displayed is number 2. Information zone ● The voltage values **V1N**, **V2N**, and **V3N** are displayed. Navigation zone ● The navigation options for the **V** screen are displayed.

The front display module FDM121 also has white backlighting:

- The backlighting comes on for 3 minutes each time a navigation key is pressed.
- The backlighting blinks every 250 ms when a prohibited ULP modular unit configuration is detected (for example, 2 identical modules being part of the same IMU).
- The backlighting blinks once a second when test mode is active (see *Test Button, page 74*).

Navigation Keys

The five navigation keys provide quick and intuitive navigation:



1 Back/Home key
2 Down key
3 Confirm/clear/set-up key
4 Up key
5 Context-sensitive key

The navigation zone indicates which navigation options are available using the keys, depending on the menu displayed.

The table below lists the navigation options offered by the five keys on the front display module FDM121. When no icon is displayed in the zone corresponding to a key, this key is inactive for the menu displayed.

Key	Icon	Navigation option
Back/Home	←	Exits a menu or a sub-menu and returns to the previous menu
	⌂	Used to return to the main menu from the **Quick view** menu displayed when the front display module FDM121 is powered up
Down	▼	Points to the desired measurements or moves on to the next screen
Confirm/ Clear/ Set-up	OK	Validates selection of a menu option
	Clear	Clears a pop-up screen
	🔧	Used to access the time and date settings
Up	▲	Points to the desired measurements or goes back to the previous screen
Context-sensitive	☰	Displays measurements in bar graph mode
	◿	Displays measurements in dial mode
	888	Displays measurements in numeric mode
	+🔍	Used to display detailed information for an event in the event log or for an alarm in the alarm history
	-🔍	Used to return to the event log or alarm history

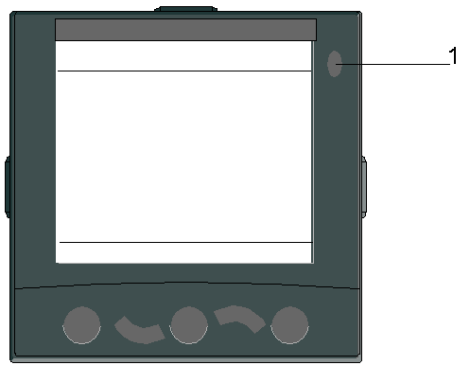
Alarm Indicator LED

The user can associate an alarm with any measurement or event in the intelligent modular unit (IMU).

Four priority levels have been defined for the alarms:
- Level 0: No priority has been assigned to the alarm
- Level 1: Low priority
- Level 2: Medium priority
- Level 3: High priority

The alarm parameters are set and priorities assigned using the RSU software. For more information about alarm setup and priorities, refer to the *RSU Online Help* and the *Micrologic 5 and 6 trip units - User manual*.

An orange alarm indicator LED alerts the user when an alarm trips in the IMU. It also indicates that one of the IMU ULP modules is in degraded mode or off.



1 Alarm indicator LED

LED Status	Meaning
Steady OFF	Nominal operation (no alarm detected, no module degraded or off)

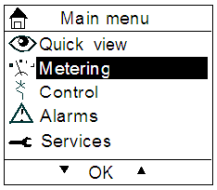
Blinking	• At least one pop-up screen is displayed. A pop-up screen is displayed in the following cases:
	  • Occurrence of a level 3 alarm (high priority)
	  • Occurrence of a trip
	  The pop-up screen is cleared and the LED is extinguished by pressing the validation key (Clear).
	• And/or an IMU module is off.
	The LED goes off after acknowledgment on the non-operational module or when the module concerned is no longer off.

Steady ON	• At least one level 2 alarm (medium priority) has tripped since the alarm history was last viewed. The LED goes off after the alarm history has been viewed. • And/or an IMU module other than the front display module FDM121 is in degraded mode. The LED goes off after acknowledgment on the degraded module or when the module concerned is no longer degraded.

Main Menu

Presentation

The **Main** menu offers 5 menus containing the information required for monitoring and using the IMUs.



NOTE: The functions available and the content of the menus depend on the IMU. For more information, refer to the documentation for the device connected to the front display module FDM121. For example, if you have a front display module FDM121 connected to a Compact NSX, refer to the *Compact NSX Micrologic 5/6 User Manual*.

The 5 menus available in the **Main** menu are as follows:

Menu	Description
Quick view	**Quick view** menu *(see page 93)* The **Quick view** menu provides quick access to the information essential for operation.
Metering	**Metering** menu *(see page 95)* The **Metering** menu displays the data made available by a Micrologic trip unit: ● Current, voltage, power, energy and harmonic distortion measurements ● Minimum and maximum metering values
Control	**Control** menu *(see page 97)* The **Control** menu is used to control a circuit breaker equipped with a communicating motor mechanism from the front display module FDM121. The proposed commands are: ● Circuit breaker opening ● Circuit breaker closing ● Circuit breaker reset after trip
Alarms	**Alarms** menu *(see page 99)* The **Alarms** menu is used to display: ● The log file for the last 40 events/alarms detected by the device connected to the front display module FDM121 since the last power-up ● The alarm/event history (alarms, trips, maintenance, control status, etc.) for the device connected to the front display module FDM121
Services	**Services** menu *(see page 102)* The **Services** menu contains all the set-up functions for the front display module FDM121 and the operating assistance information: ● Reset (peak demand values, energy meters) ● Set-up (display module date and time, parameters) ● Maintenance (operation counters, load profile, etc.) ● Product version: Identification of the IMU modules ● Langue.

Navigation

Navigation within the **Main** menu is as follows:

- The ▲ and ▼ keys are used to select one of the 5 menus.
- The OK key is used to confirm the selection.

Quick View Menu

Presentation

The **Quick view** menu presents information that is essential for operating the device connected to the front display module FDM121, divided into a number of screens.

The **Quick view** menu is displayed by default when the front display module FDM121 is powered up.

The number of available screens and their content depend on the device connected to the front display module FDM121. For example, with Compact NSX circuit breakers, they depend on:

- The type of Micrologic trip unit (A or E)
- The number of circuit breaker poles (3-pole or 4-pole)
- The presence of options (ENVT or ENCT)

The screen number and number of available screens are indicated in the top right-hand corner of the display.

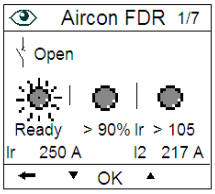
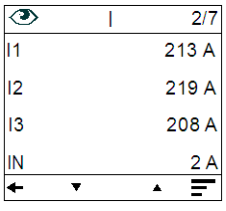
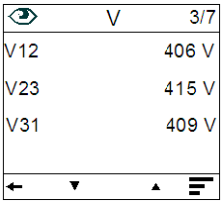
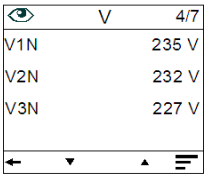
Navigation

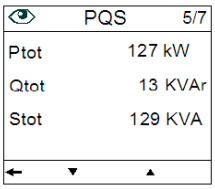
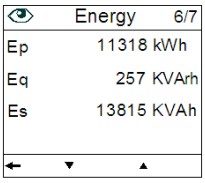
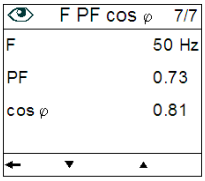
Navigation within the **Quick view** menu is as follows:

- The ▲ and ▼ keys are used to go from one screen to another.
- The ← key is used to return to the previous menu.
- The ☰, ◺, and 888 keys are used to modify how measurements are displayed.
- The ⌂ key is used to return to the main menu from the **Quick view** menu displayed when the front display module FDM121 is powered up.

Example of Screens in the Quick View Menu

The table below shows screens 1 to 7 of the **Quick view** menu for a Compact NSX 4-pole circuit breaker equipped with a Micrologic E trip unit:

Screen	Description
	Screen 1 in the **Quick view** menu displays: ● The name of the IMU (Aircon FDR on the screen example opposite). The name of the IMU defined with RSU can be up to 45 characters long, but only the first 14 characters are visible on the front display module FDM121. ● The *Open/Closed/Trip* status of the Compact NSX circuit breaker (if the BSCM module is present (Open on the screen example opposite) ● The status of the LED indicators on the front of the trip unit ● The long time protection Ir pick-up setting ● The current intensity of the most heavily loaded phase (I2 = 217 A in the screen example opposite)
	Screen 2 in the **Quick view** menu displays the currents: ● Phase 1 current I1 ● Phase 2 current I2 ● Phase 3 current I3 ● Neutral current IN
	Screen 3 in the **Quick view** menu displays the phase-to-phase voltages: ● Phase 1 to phase 2 voltage V12 ● Phase 2 to phase 3 voltage V23 ● Phase 3 to phase 1 voltage V31
	Screen 4 in the **Quick view** menu displays the phase-to-neutral voltages: ● Phase 1 to neutral voltage V1N ● Phase 2 to neutral voltage V2N ● Phase 3 to neutral voltage V3N

Screen	Description
	Screen 5 in the **Quick view** menu displays the powers: ● Active power Ptot in kW ● Reactive power Qtot in kvar ● Apparent power Stot in kVA
	Screen 6 in the **Quick view** menu displays the energy meters: ● Active energy Ep in kWh ● Reactive energy Eq in kvarh ● Apparent energy Es in kVAh
	Screen 7 in the **Quick view** menu displays: ● The frequency F in Hz ● The power factor PF ● The cos φ

Number of Available Screens

The number of screens available in the **Quick view** menu varies dependent upon the type of device connected to the front display module FDM121.

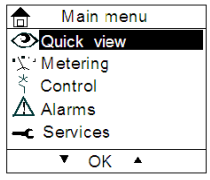
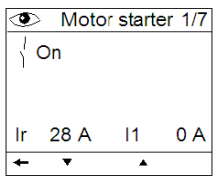
The examples below illustrate the number of screens available according to the type of Compact NSX circuit breaker and/or the type of Micrologic trip unit.

- If the Compact NSX circuit breaker type is 4-pole equipped with a Micrologic type A trip unit, screens 1 and 2 are available.
- If the Compact NSX circuit breaker type is 4-pole equipped with a Micrologic type E trip unit, screens 1 to 7 are available.
- If the Compact NSX circuit breaker type is 3-pole without ENCT option, the IN current is not available on screen 2.
- If the Compact NSX circuit breaker type is 3-pole without ENVT option equipped with a Micrologic type E trip unit, screen 4 is not available.

Intelligent Modular Unit (IMU) Name

For optimum use of the electrical equipment, the RSU software can be used to assign a name to the IMU relating to the function with which it is associated (for more information, see *IMU Name and Location, page 127*).

The procedure for displaying the IMU name is as follows:

Step	Action	Display
1	Select the **Quick view** menu in the main menu using the ▲ and ▼ keys. Validate selection of the **Quick view** menu by pressing the OK key.	
2	Screen 1 in the **Quick view** menu displays the IMU name: Motor-feeder. The IMU name defined with RSU can consist of 45 characters maximum, but only the first 14 characters are visible on the front display module FDM121.	

Metering Menu

Presentation

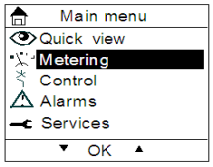
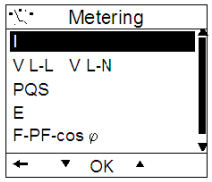
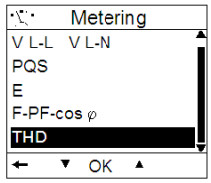
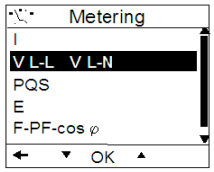
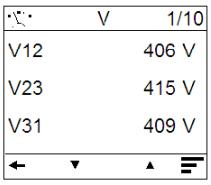
The **Metering** menu is used to display current, voltage, energy measurements, etc.

The complete list of measurements displayed depends on the device connected to the front display module FDM121.

The descriptions below are based on the example of a Compact NSX circuit breaker equipped with a Micrologic 5.x E trip unit connected to the front display module FDM121.

Navigation

The table below describes access, the screens in the **Metering** menu, and the selection of voltage measurements:

Step	Action	Display
1	Select the **Metering** menu in the **Main** menu using the ▼ and ▲ keys. Validate selection of the **Metering** menu by pressing the OK key.	
2	The following selections can be made in the **Metering** menu: ● Currents ● Voltages ● Powers ● Energies ● Frequency, power factor, and cos φ ● Total harmonic distortion THD	 
3	Select, for example, the **V L-L V L-N** sub-menu in the **Metering** menu using the ▼ and ▲ keys.	
4	Screen 1/10 in the **V L-L V L-N** sub-menu is displayed, with the phase-to-phase voltage values. The ▼ and ▲ keys are used to switch from one screen to another and display all the metering screens in the **V L-L V L-N** sub-menu. The ☰ key is used to modify the display mode and to switch to bargraph mode.	

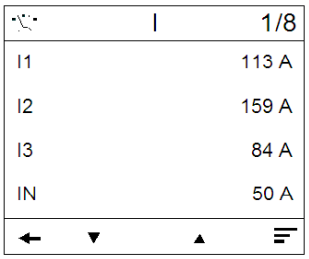
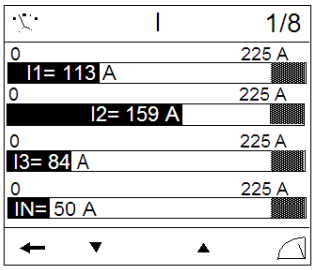
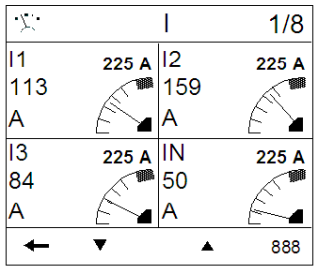
NOTE: The ← key is used to return to the **Metering** menu.

Measurement Display Modes

The current, voltage and power measurements can be displayed in 3 different ways, using the context-sensitive key to switch from one display mode to another:

- The icon represents bargraph mode display.
- The icon represents dial mode display.
- The 888 icon represents numeric mode display.

The table below shows an example display for current in the 3 modes:

Numeric Mode	Bar Graph Mode	Dial Mode
		
Press the key to switch the display to bargraph mode.	Press the key to switch the display to dial mode.	Press the 888 key to switch the display to numeric mode.

Control Menu

Presentation

The **Control** menu is used to control a device from the front display module FDM121.

For example, the following control modes are supported for a Compact NSX circuit breaker equipped with a communicating motor mechanism and a BSCM module greater than or equal to version V2.1.7:

- Selection of the control mode: **Local**/**Remote**
  - In **Local** mode, only commands from the front display module FDM121 are accepted.
  - In **Remote** mode, only commands from the Modbus communication interface are accepted.
- Circuit breaker control in **Local** mode:
  - **Open**: Opens the circuit breaker
  - **Close**: Closes the circuit breaker

NOTE: Local and **Remote** modes are mutually exclusive.

NOTE: If the front display module FDM121 backlighting is blinking, it means that the IMU is operating in degraded mode. It may be an architecture problem. For more information, refer to the relevant section *(see page 27)*.

If the IMU operating in degraded mode includes a front display module FDM121 version lower than V2.1.3, there is a risk of controlling a different device to the one wanted.

⚠ DANGER

RISK OF ELECTROCUTION, ELECTRIC ARC OR BURNS

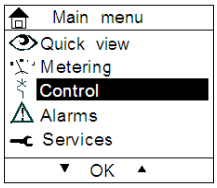
When the front display module FDM121 backlighting is blinking:

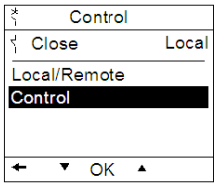
Do not execute any commands from the display unit before returning the IMU to nominal operating mode.

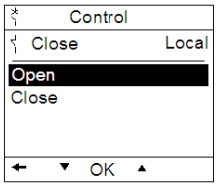
Failure to follow these instructions will result in death or serious injury.

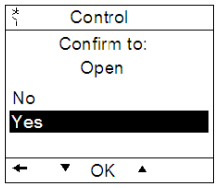
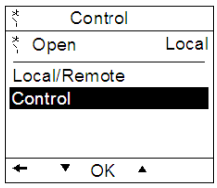
Navigation

The table below lists the commands in the **Control** menu which can be used to control the circuit breaker in local mode:

Step	Action	Display
1	Select the **Control** menu in the **Main** menu using the ▼ and ▲ keys. Validate selection of the **Control** menu by pressing the OK key.	

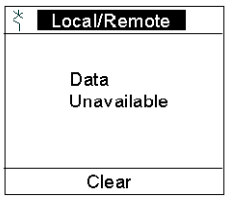
2	The **Control** screen is divided into 2 parts:
	● The part at the top indicates the circuit breaker status:
	  ● Circuit breaker status: open or closed
	  ● Circuit breaker control mode: **Remote** or **Local**
	● The part at the bottom indicates the possible actions which can be carried out on the circuit breaker in the form of a menu:
	  ● Selection of the control mode: **Local**/**Remote**
	  ● Circuit breaker control: **Control**
	Select **Control** from the menu to control the circuit breaker.
	Validate your selection by pressing the OK key.
		

3	Select **Open** to open the circuit breaker. Validate your selection by pressing the OK key.	

Step	Action	Display
4	A screen confirming the action to be carried out is displayed. Select **Yes** to confirm the opening of the circuit breaker. **NOTE:** You are not prompted to confirm your selection when you select the circuit breaker control mode (**Local**/**Remote**).	
5	The new circuit breaker status is displayed in the top part of the screen.	

NOTE:

- The ← key is used to return to the **Control**menu.
- If there is no communicating motor mechanism or if the BSCM module version is lower than V2.1.7, the **Local**/**Remote** sub-menu displays the screen below.



Press the **Clear** key to return to the **Control** menu.

Alarms Menu

Presentation

The front display module FDM121 signals the appearance of a high-priority or medium-priority alarm in realtime. An alarm of this type can be associated with:
- A measurement
- A trip, failure or maintenance event

The **Alarms** menu is used to view the event log and the alarm history.

The event log contains the last 40 alarms triggered since the front display module FDM121 was last powered up. The level of priority is indicated for each event.

Alarms can be displayed by type in the alarm history:
- Alarms
- Trip
- Maintenance op.
- Device status and control

NOTE: The alarm history is saved in the device. It can be accessed at all times, even after the front display module FDM121 has been replaced or added.

Alarm Indication

The alarms are displayed on the front display module FDM121 in order of their appearance. The most recent alarm to appear replaces the previous one, even if it is still active or has not been acknowledged.

The alarms are available in the alarm history.

Alarms are indicated on the display in accordance with their order of priority.

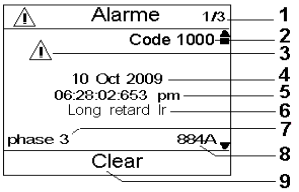
Priority	Indication in realtime	History	Clearing of alarm
High priority	● Flashing LED ● Pop-up	Yes	The LED stops flashing and the pop-up disappears after the Clear key has been pressed.
Medium priority	● LED steady ON	Yes	The LED goes off after the alarm history has been viewed.
Low priority	–	Yes	–
No priority	–	No	–

NOTE: Press the Clear key repeatedly (as many times as there are active alarms) to clear the display of the high-priority alarms one after the other in reverse chronological order to that in which they appeared.

All medium-priority alarms indicated are cleared once the history has been viewed.

Alarm Pop-up

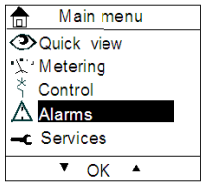
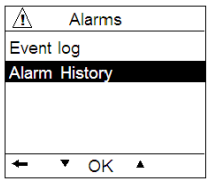
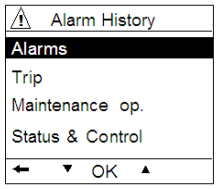
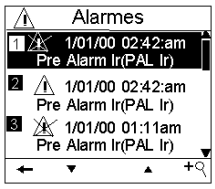
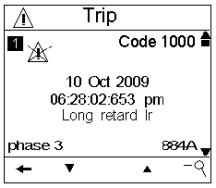
An alarm pop-up appears instantly when a high-priority alarm is triggered. The figure below shows an example alarm pop-up:



1 Alarm display number
2 Alarm code
3 Alarm symbol
4 Alarm date
5 Alarm time in hours, minutes, seconds, and milliseconds
6 Alarm name
7 Number of the phase affected
8 Measured value when the alarm was triggered (in A)
9 Clear key to clear the alarm pop-up displayed

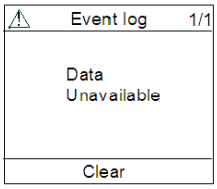
Navigation

The table below presents an example alarm history view:

Step	Action	Display
1	Select the **Alarms** menu in the **Main** menu using the ▼ and ▲ keys. Validate selection of the **Alarms** menu by pressing the OK key.	
2	2 sub-menus are available: **Event log** and **Alarm History**. The method of navigation in both sub-menus is the same. Select one of the sub-menus using the ▼ and ▲ keys. Validate selection of the sub-menu by pressing the OK key.	
3	The following selections can be made in the **Alarm History** sub-menu: ● Alarms ● Trip ● Maintenance op. ● Device status and control Select the **Alarms** sub-menu using the ▼ and ▲ keys. Validate selection of the sub-menu by pressing the OK key.	
4	The alarm history is displayed, with the alarms listed in reverse chronological order to that in which they were triggered. Press the ▼ and ▲ keys to switch from one alarm to another. Press the +🔍 key to display detailed information about an alarm.	
5	Press the ▼ and ▲ keys to display detailed information about a previous or subsequent alarm in the history. Press the -🔍 key to return to the alarm history.	

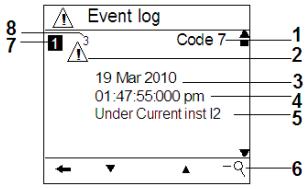
NOTE:

If no alarms have occurred since the front display module FDM121 was powered up, the **Event log** sub-menu displays the screen below. Press the Clear key to return to the **Alarms** menu.



Details Screen for an Event or an Alarm

The details screen in the event log is identical to the details screen in the alarm history in every way except that it also indicates the alarm priority.



1 Alarm code
2 Type of event or alarm (1)
3 Date the event or alarm occurred
4 Event or alarm time in hours, minutes, seconds, and milliseconds
5 Name of event or alarm
6 Key to return to the event log or alarm history
7 Screen number
8 Alarm priority level (indicated in the event log only)

(1) occurrence ⚠ or completion ⚠ of the alarm.

Services Menu

Presentation

The **Services** menu provides access to the:
- Reset energy meters and minimum and maximum metering values mode
- Date and time settings from the front display module FDM121
- Front display module FDM121 contrast and brightness settings
- Maintenance indicators (operation counters, load profile, etc.)
- IMU product identification information
- Language selection for the front display module FDM121 screens

Information Retained in the Event of a Power Failure

If its power supply fails, the front display module FDM121 retains the following:
- Choice of language
- Contrast setting
- Brightness setting
- The name of the IMU of which it is part

If the power supply fails, the following information is lost:
- The log file for the last 40 events
- The date and time

NOTE: The alarm history is saved in the device. It is not sensitive to power supply failures affecting the front display module FDM121.

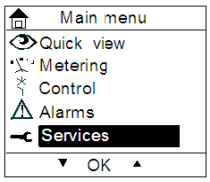
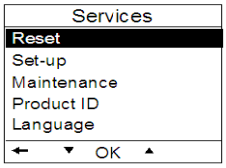
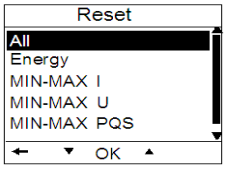
Reset Sub-Menu

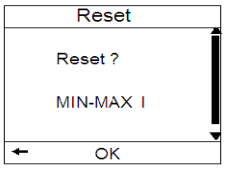
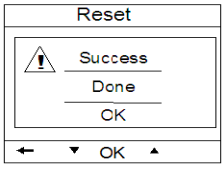
The **Reset** sub-menu can be used to reset the:
- Three energy meters and all minimum and maximum measurement values in a single operation
- Three energy meters: The energy meters are reset simultaneously on the active energy (Ep), reactive energy (Eq), and apparent energy (Es) meters
- Minimum and maximum values by metering group

For the group of currents, for example, all of the following minimum and maximum values are reset simultaneously:
- Phase currents and neutral current (if present)
- Unbalance currents
- Demand current

Navigation

The table below presents an example of navigation in the **Services** menu to reset the metering groups of a Compact NSX circuit breaker.

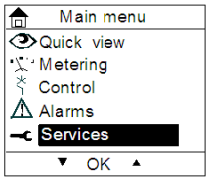
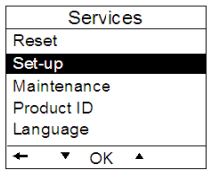
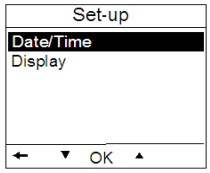
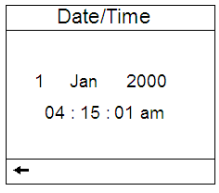
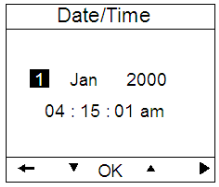
Step	Action	Display
1	Select the **Services** menu in the **Main** menu using the ▼ and ▲ keys. Validate selection of the **Services** menu by pressing the OK key.	
2	The **Services** menu is displayed. Select the **Reset** sub-menu using the ▼ and ▲ keys. Validate selection of the sub-menu by pressing the OK key.	
3	The **Reset** menu is displayed, where you can select a general reset or reset by metering group. Select **MIN-MAX I** using the ▼ and ▲ keys to reset all the minimum and maximum values of the currents. Validate selection of resetting the **MIN-MAX I** group by pressing the OK key.	

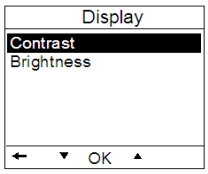
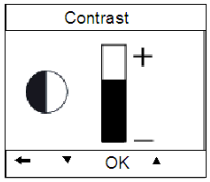
Step	Action	Display
4	A confirmation message is displayed whichever **Reset** sub-menu is selected. Confirm resetting the **MIN-MAX I** group by pressing the OK key a second time.	
5	A confirmation message is displayed whichever **Reset** sub-menu is selected. Pressing the OK key returns to the **Reset** sub-menu.	

NOTE: The ← key is used to return to the **Services** menu.

Setting the Date and Time and Other Parameters on the Display Module

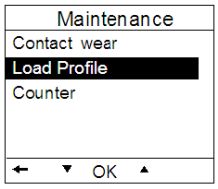
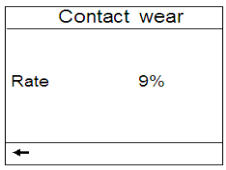
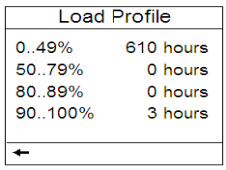
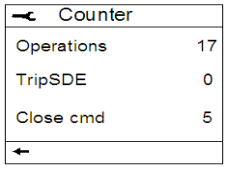
The table below shows how to set the date and time, as well as the contrast, on the front display module FDM121 from the **Services** menu:

Step	Action	Display
1	Select the **Services** menu in the **Main** menu using the ▼ and ▲ keys. Validate selection of the **Services** menu by pressing the OK key.	
2	The **Services** menu is displayed. Select the **Set-up** sub-menu using the ▼ and ▲ keys. Validate selection of the **Set-up** sub-menu by pressing the OK key.	
3	The **Set-up** sub-menu is displayed. Validate selection of the **Date/Time** sub-menu by pressing the OK key.	
4	The **Date/Time** sub-menu is displayed. Press the key to set the system date and time.	
5	Select the field to set; the display switches to reverse video when you press the ▶ key. Use the ▼ and ▲ keys to adjust the content of the selected field. Press the OK key to confirm your settings.	

Step	Action	Display
6	The **Display** sub-menu is used to set the display module parameters. Select the **Contrast** sub-menu using the ▼ and ▲ keys. Validate selection of the **Contrast** sub-menu by pressing the OK key.	
7	The **Contrast** sub-menu is displayed. Set the contrast using the ▼ and ▲ keys. Validate the contrast setting by pressing the OK key. **NOTE:** Identical settings are made in the **Brightness** menu.	

Maintenance Sub-Menu Screens

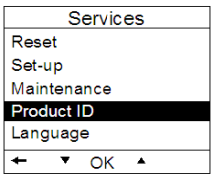
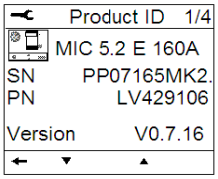
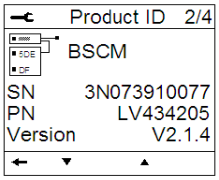
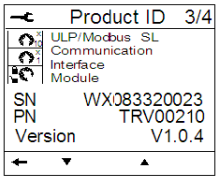
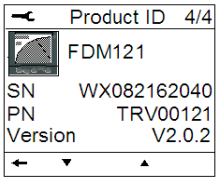
The table below presents the screens in the **Maintenance** sub-menu available on the front display module FDM121 connected to a Compact NSX circuit breaker. The **Maintenance** sub-menu is accessible from the **Services** menu in the **Main** menu.

Screens	Description
	The three screens in the **Maintenance** sub-menu are accessed using the navigation arrows and the OK key.
	The **Contact wear** screen in the **Maintenance** sub-menu displays the amount of wear on the circuit breaker contacts.
	The **Load Profile** screen in the **Maintenance** sub-menu displays 4 circuit breaker operating hours counters for 4 loading sections.
	The **Counter** in the **Maintenance** sub-menu displays the values of the: • OF operation counter • SDE fault counter • Close command counter (communicating motor mechanism)

Product Version

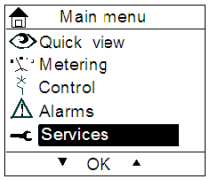
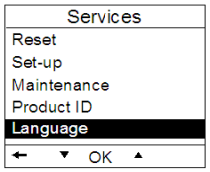
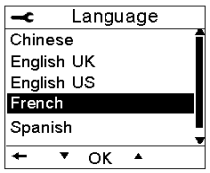
The front display module FDM121 identifies every module in the IMU it is part of: for each module, it displays the serial number, the part number and the version.

The procedure below shows how to access the module versions for an IMU consisting of a Compact NSX circuit breaker equipped with a BSCM and a Micrologic 5.2 E trip unit, a front display module FDM121 and a Modbus communication interface module.

Step	Action	Display
1	Select the **Services** menu in the main menu, then select the **Product ID** sub-menu using the ▼ and ▲ keys. Pressing the OK key validates selection of the **Product ID** sub-menu.	
2	The first screen displays the identifying information for the Micrologic trip unit: ● Type of Micrologic trip unit ● SN = Serial number ● PN = Micrologic trip unit part number ● Version = Firmware version Pressing the ▼ key switches to the next screen. Pressing the ▲ key switches back to the previous screen.	
3	The next screen displays the identifying information for the BSCM: ● BSCM ● SN = Serial number ● PN = BSCM part number ● Version = Firmware version	
4	The next screen displays the identifying information for the Modbus communication interface module: ● Modbus communication interface module ● SN = Serial number ● PN = Modbus communication interface module part number ● Version = Firmware version	
5	The next screen displays the identifying information for the front display module FDM121: ● FDM121 ● SN = Serial number ● PN = Front display module FDM121 part number ● Version = Firmware version	

Choice of Language

The table below shows how to choose the language on the front display module FDM121 from the **Services** menu:

Step	Action	Display
1	Select the **Services** menu in the **Main** menu using the ▼ and ▲ keys. Validate selection of the **Services** menu by pressing the OK key.	
2	The **Services** menu is displayed. Select the **Language** sub-menu using the ▼ and ▲ keys. Validate selection of the **Language** sub-menu by pressing the OK key. **NOTE:** In order to be able to change language easily, whichever language has been chosen , the **Language** sub-menu label is only in English.	
3	The **Language** sub-menu is displayed. Select the desired display language using the ▼ and ▲ keys. Validate selection of the language by pressing the OK key.	

3.3 Maintenance Module

Aim of this Section

This section describes the maintenance module.

What's in this Section?

This section contains the following topics:

Topic	Page
Presentation of the Maintenance Module	108
Mounting the Maintenance Module	111
Connection to the Test Port on the Micrologic Trip Unit	112
Maintenance Module ULP Connection	113
Using the Maintenance Module Connected to the Test Port on the Micrologic Trip Unit	115
Using the Maintenance Module Connected to the ULP System	118
Use - Summary	120

Presentation of the Maintenance Module

Introduction

The maintenance module is dedicated to the testing and maintenance of the IMU ULP modules and their accessories.

Connection to the IMU

The maintenance module is connected to the IMU in one of 2 ways:

- Connection to the test port on the Micrologic trip unit:
  Connection to the test port on the Micrologic trip unit allows connection on the front of the switchboard.
- ULP connection:
  The maintenance module is connected to a ULP port on one of the IMU ULP modules.

Operating Modes

The maintenance module operates in one of 2 modes:

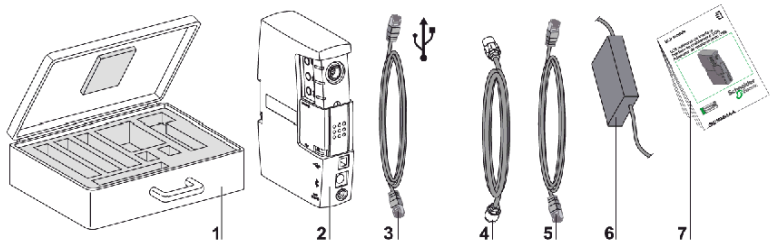
- In offline mode (not connected to a PC), the maintenance module is connected to the test port on the Micrologic trip unit and as such can be used to perform:
  - Tripping tests
  - The inhibition functions required for tripping tests by primary current injection
- In online mode (connected to a PC via USB or Bluetooth) with LTU (Local Test Utility) and RSU (Remote Setting Utility) software, the maintenance module can be used to:
  - Set the protection parameters (RSU)
  - Display the protection parameters (RSU and LTU)
  - Set the alarm parameters (RSU)
  - Display the alarm parameters (RSU and LTU)
  - Display the settings curves (RSU and LTU)
  - Simulate alarms and tripping on the Compact NSX circuit breaker (LTU)
  - Check discrimination and the ZSI (Zone Selective Interlocking) function (LTU)
  - Store all the operating data and maintenance tests in a dedicated file for each Compact NSX circuit breaker (LTU)
  - Set the Modbus interface module communication parameters (RSU)
  - Update the firmware in the IMU modules (RSU)
  - Reset passwords associated with the IMU (RSU)

NOTE: The LTU software only works with a connection to the test port on the Micrologic trip unit. The RSU software works with both types of connection.

For more information about the RSU and LTU software, refer to the *RSU and LTU online help*.

Maintenance Kit

The maintenance kit consists of a case containing the following items:



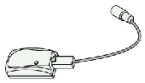
1 Case
2 Maintenance module
3 USB cable for connection to a PC
4 Cable for connecting the maintenance module to the test port on the trip unit
5 ULP cable
6 24 V DC external power supply unit for the maintenance module
7 Instruction sheet

NOTE: When the 24 V DC external power supply unit is used to power the maintenance module, it should be connected to a 110/230 V power supply, overvoltage category II, in accordance with standard IEC 60664 for the protection of persons.

Bluetooth Option

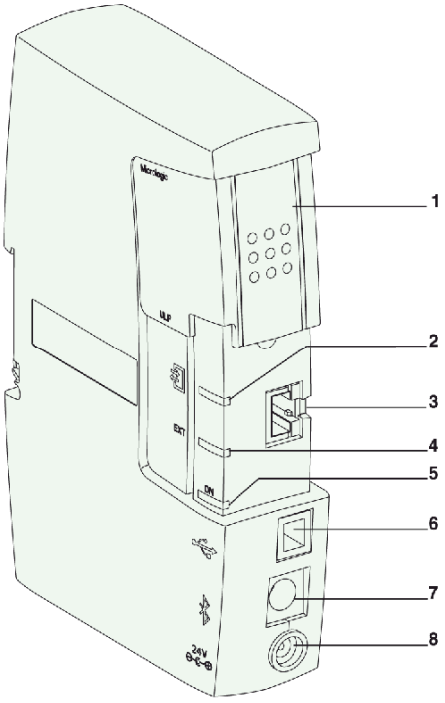
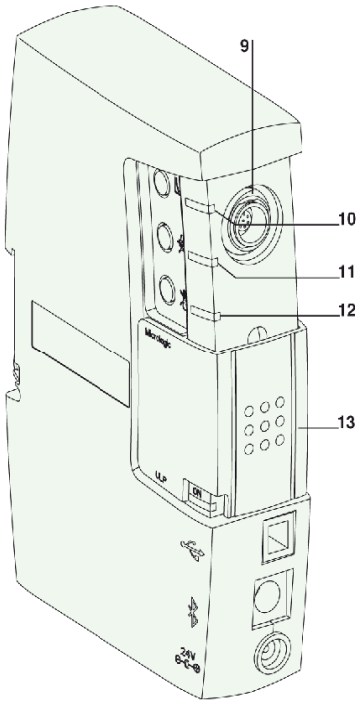
If desired, the user can order the optional Bluetooth connection.

The Bluetooth option consists of a Bluetooth module which connects to the maintenance module. The Bluetooth key for PC is not supplied.



Maintenance Module

The table below describes the 2 types of connection for the maintenance module, depending on the position of the sliding mechanical cap:

ULP Connection	Connection to the Test Port on the Micrologic Trip Unit
	
1 Sliding mechanical cap in ULP position **2** ULP communication LED **3** ULP connector **4** LED indicating that the 24 V DC external power supply needs to be connected **5** ON LED **6** USB connector **7** Bluetooth adapter connector **8** 24 V DC external power supply unit input	**9** Connection socket for special cable connecting maintenance module to test port on Micrologic trip unit **10** Electrical push to trip test button and LED indicator **11** Inhibit ground fault protection button and LED indicator **12** Inhibit thermal memory button and LED indicator **13** Sliding mechanical cap in test position

Characteristics

The maintenance module has the following characteristics:

Dimensions	112 x 164 x 42 mm
Operating temperature	-10...+55°C
Power supply voltage	24 V DC -20%/+10% (19.2...26.4 V DC)
Consumption	• Without Bluetooth option: 60 mA/24 V DC at 20°C • With Bluetooth option: 100 mA/24 V DC at 20°C

Part Numbers

The table below lists the part numbers for the components in the maintenance kit:

Product	Description	Part Number
Maintenance kit	Case, maintenance module, external power supply unit, and associated cables	TRV00910
Maintenance module	–	TRV00911
24 V DC power supply for maintenance module	–	TRV00915
Micrologic test cable	Cable for connecting the maintenance module to the test port on the Micrologic trip unit	TRV00917
Bluetooth option	Bluetooth module for connection to the maintenance module	VW3A8114
RSU software	Remote Setting Utility	LV4ST100
LTU software	Local Test Utility	LV4ST121

Mounting the Maintenance Module

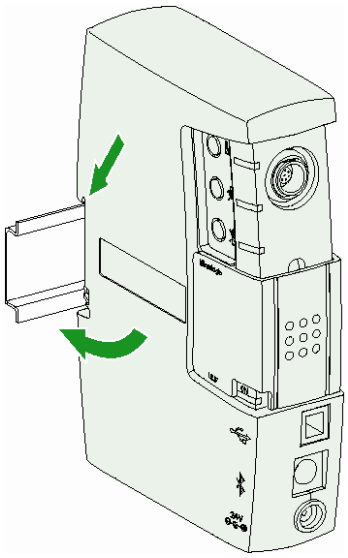
Mounting

There are two possible mounting configurations for the maintenance module:

- Mounting on DIN rail
- Mounting by magnetic fixing

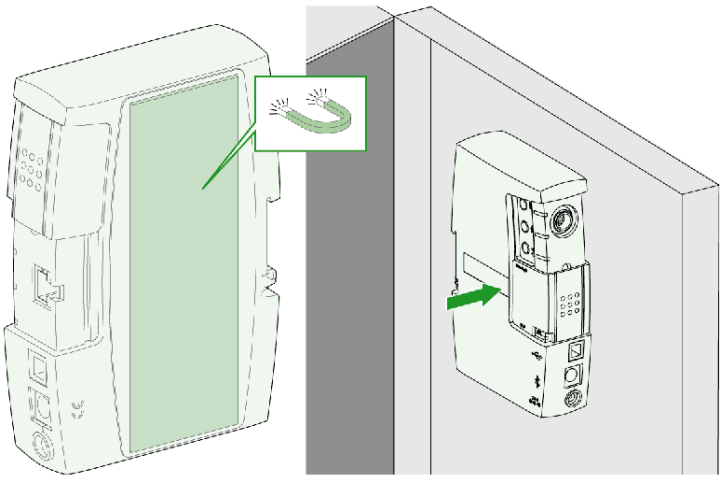
Mounting on DIN Rail

The figure below shows the maintenance module mounted on a DIN rail:



Mounting by Magnetic Fixing

The figure below shows the maintenance module mounted magnetically:



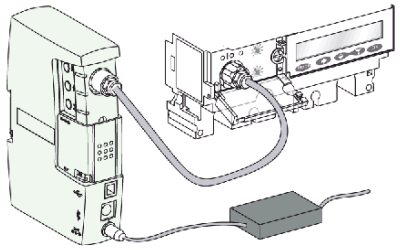
Connection to the Test Port on the Micrologic Trip Unit

Introduction

The maintenance module is connected to the test port on the Micrologic trip unit using the test cable supplied in the maintenance kit. The maintenance module's sliding mechanical cap is in the Micrologic position.

Connection in Standalone Mode

In standalone mode, the maintenance module is not connected to a PC. The maintenance module is connected to the test port on the Micrologic trip unit and must be powered by the 24 VDC external power supply unit provided in the maintenance kit.



In standalone mode, the maintenance module can be used to perform the Compact NSX circuit breaker tripping tests and the inhibit ground fault protection and thermal memory tests. For more information on these three functions, refer to *Test Functions, page 115*.

Connection to a PC

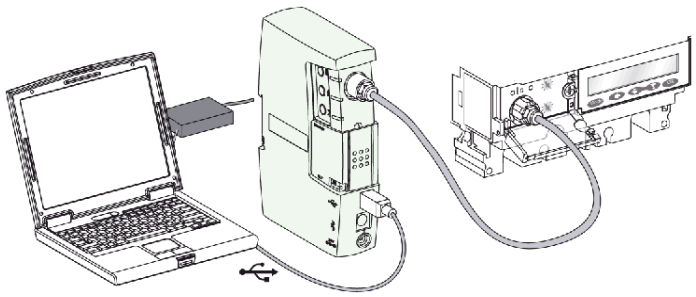
The maintenance module connected to a PC can be used to carry out the complete range of checks, tests and adjustments on the IMU ULP modules, using the RSU and LTU software.

There are two possible configurations for connecting the maintenance module to a PC:

- Using the USB port
- Using the Bluetooth option

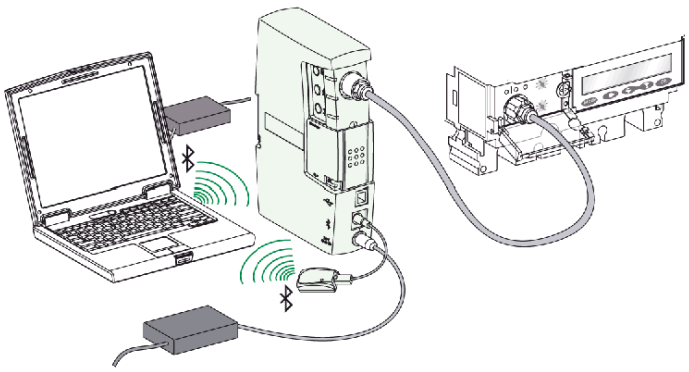
USB Connection

The figure below shows the maintenance module's USB connection to the test port on a Micrologic trip unit. The maintenance module is powered via the USB port:



Bluetooth Connection

The figure below shows the maintenance module's Bluetooth connection to the test port on a Micrologic trip unit. The maintenance module must be powered by the 24 VDC external power supply unit provided in the maintenance kit:



Maintenance Module ULP Connection

Introduction

The maintenance module ULP is connected to the IMU using the ULP cable provided in the maintenance kit. The maintenance module sliding mechanical cap is in the ULP position.

When the maintenance module ULP is connected to a communicating IMU over Modbus, it is important that the Modbus connection rules are followed.

⚠ WARNING

RISK OF ELECTROCUTION, ELECTRIC ARC OR BURNS

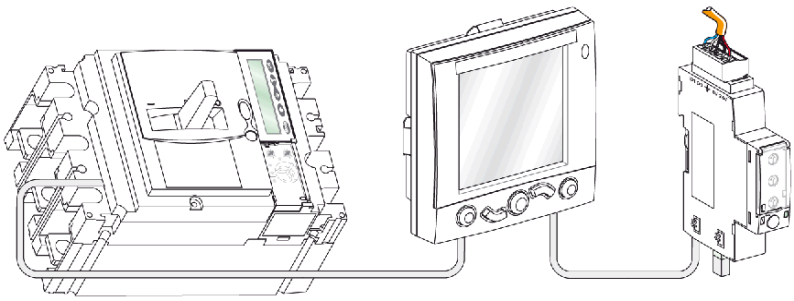
Do not connect the switchboard's internal Modbus network to an external Modbus network without inserting an isolation barrier.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

For more information, refer to *Connection to the Modbus Master, page 38*.

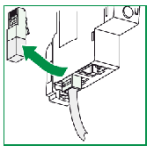
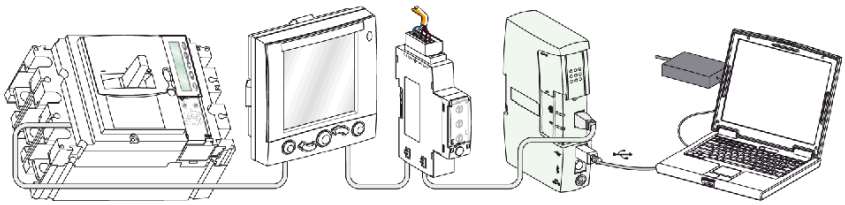
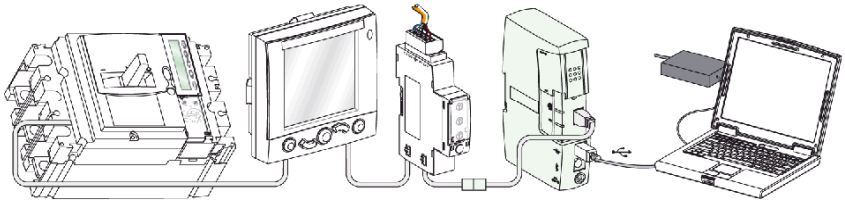
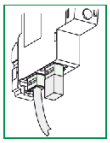
Example of ULP Connection

Our example is on an IMU consisting of a Modbus communication interface module, a Compact NSX circuit breaker and a front display module FDM121. The maintenance module ULP is connected to an unused ULP connector on an IMU module:



Connection Procedure

The procedure for connecting the maintenance module ULP to the IMU is as follows:

Step	Action
1	Disconnect the ULP termination from the Modbus communication interface module: 
2	Connect the maintenance module to the Modbus communication interface module using the ULP cable supplied in the maintenance kit:  If the ULP cable is too short, use an RJ45 female/female connector and a second ULP cable: 
3	Use the RSU software to set the parameters or update the firmware.
4	When the parameter-setting or firmware update operations have been completed, close the ULP connector on the Modbus communication interface module using the ULP termination: 

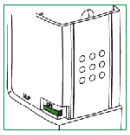
Using the Maintenance Module Connected to the Test Port on the Micrologic Trip Unit

Offline Mode

In offline mode, the maintenance module is not connected to a PC. It is connected to the test port on the Micrologic trip unit and must be powered by the 24 V DC external power supply unit provided in the maintenance kit.

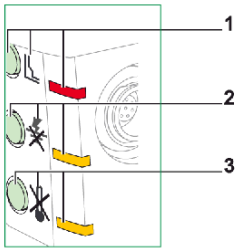
ON LED

The green ON LED indicates that the maintenance module is supplied with power and operating correctly.



Test Functions

Tests are carried out by means of the three test buttons. A pictogram and an LED are associated with each button.



1 Push to trip
2 Inhibit ground fault protection
3 Inhibit thermal memory

The table below describes the functions possible with the maintenance module connected in offline mode to the test port on the Micrologic trip unit:

Function	Description
Push to trip	• Pressing the push to trip button trips the Compact NSX circuit breaker. • The behavior of the associated LED is described in *Push to Trip LED, page 115*.
Inhibit ground fault protection	• Pressing the inhibit ground fault protection button inhibits ground fault protection and the thermal memory for 15 minutes. • The behavior of the associated LED is described in *Inhibit Ground Fault Protection LED, page 116*.
Inhibit thermal memory	• Pressing the inhibit thermal memory button inhibits the thermal memory for 15 minutes. • The behavior of the associated LED is described in *Inhibit Thermal Memory LED, page 116*.

NOTE: Pressing any other test button during the 15 minutes stops the test in progress and starts the test associated with the test button that has been pressed.

Push to Trip LED

The red push to trip LED tracks the execution of the electronic trip test:

LED Status	Meaning
ON for 2 s then OFF	The trip command is sent to the Micrologic trip unit.
Always OFF	The trip command is refused by the Micrologic trip unit.

Inhibit Ground Fault Protection LED

The orange inhibit ground fault protection LED tracks the execution of the inhibit ground fault protection test:

LED Status	Meaning
ON for 15 mins then OFF	• Pressing the inhibit ground fault protection button starts the test and lights up the LED for 15 minutes (inhibit duration). At the end of the inhibit test, the LED goes off. • Pressing the inhibit ground fault protection button during the 15 minutes stops the test and extinguishes the LED. • The LED goes off and the test stops if the test cable is disconnected during the 15 minutes.
Flashing for 3 s	The ground fault protection function is not available while the Micrologic trip unit is in test mode.

Inhibit Thermal Memory LED

The orange inhibit thermal memory LED tracks the execution of the inhibit thermal memory test:

LED Status	Meaning
ON for 15 mins then OFF	• Pressing the inhibit thermal memory button starts the test and lights up the LED for 15 minutes (inhibit duration). At the end of the inhibit test, the LED goes off. • Pressing the inhibit thermal memory button during the 15 minutes stops the test and extinguishes the LED. • The LED goes off and the test stops if the test cable is disconnected during the 15 minutes.

NOTE: Pressing any other test button during the 15 minutes stops the test in progress and starts the test associated with the test button that has been pressed.

Connection to a PC

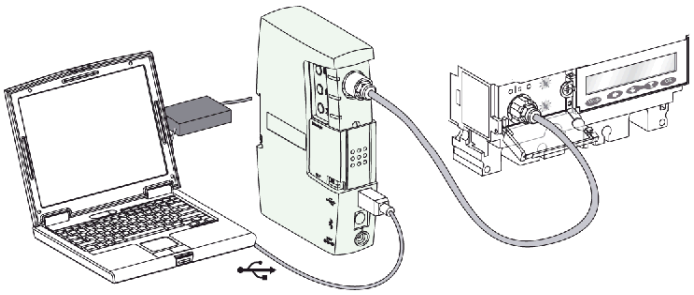
In addition to the test functions described above, the maintenance module connected to a PC via a USB port or Bluetooth connection can be used to carry out the complete range of checks, tests, and adjustments on the IMU ULP modules, using the RSU and LTU software:

- The LTU software is used to test the protection functions (Short time, Long time, Instantaneous, etc.), to simulate the Micrologic trip unit alarms, to display the currents, and to test the ZSI function.
- The RSU software is used to check and configure the protection, metering, and alarm parameters. It can also be used to check and configure the parameters of the Modbus communication interface module, the BSCM, and the SDx module.

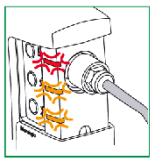
For more information about the RSU and LTU software functions, refer to the *LTU and RSU online help*.

USB Connection

In the case of a USB connection, the maintenance module is powered via the USB port.



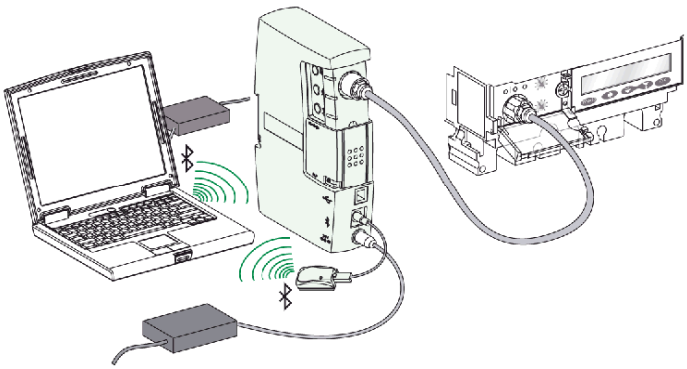
NOTE: If the USB port cannot supply power to the maintenance module (PC operating on low battery), the 3 test LEDs flash.



In this case, the maintenance module should be powered by the 24 V DC external power supply unit provided in the maintenance kit. The 24 V DC external power supply unit should be connected to a 110/230 V power supply, overvoltage category II, in accordance with standard IEC 60664 for the protection of persons.

Bluetooth Connection

In the case of a Bluetooth connection, the maintenance module is powered by the 24 V DC external power supply unit provided in the maintenance kit.



Using the Maintenance Module Connected to the ULP System

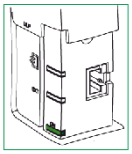
Introduction

When the sliding mechanical cap is in the ULP position, the maintenance module allows communication to be established between the IMU ULP modules and the RSU software.

The LTU software only works with a connection to the test port on the Micrologic trip unit.

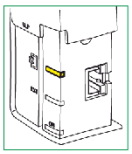
ON LED

The green ON LED indicates that the maintenance module is supplied with power and operating correctly.



ULP LED

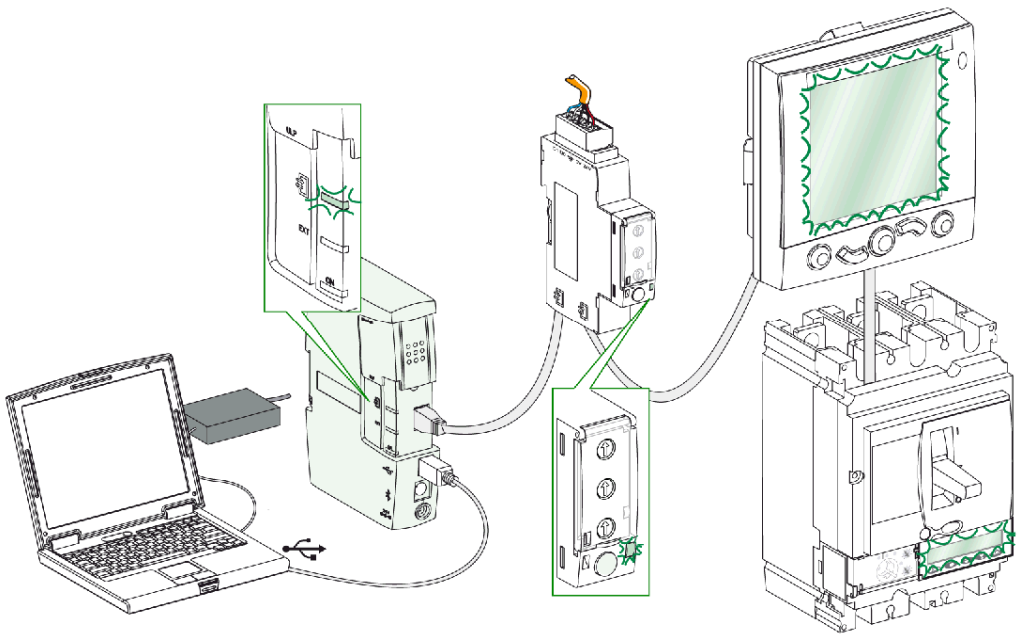
The yellow ULP LED describes the connection between the IMU ULP modules and the maintenance module.



The table below describes how the ULP LED works:

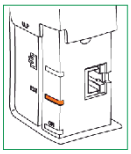
LED Status	Meaning
ON: 50 ms/OFF: 950 ms	Nominal operation: The maintenance module is supplied with power and the ULP connection is operating correctly.
ON: 250 ms/OFF: 250 ms	Prohibited configuration: Two identical modules are connected to the maintenance module in a daisy chain.
ON: 500 ms/OFF: 500 ms	Degraded mode (EEPROM off, faulty button)
ON: 1000 ms/OFF: 1000 ms	Test mode
Steady ON	The maintenance module is supplied with power but the ULP connection is not functioning.
Steady OFF	The maintenance module is not supplied with power.

The figure below shows an IMU in test mode. In test mode, the backlighting on the front display module FDM121 and Micrologic trip unit, the ULP activity LED on the Modbus communication interface module and the ULP LED on the maintenance module flash simultaneously (ON: 1000 ms/OFF: 1000 ms).



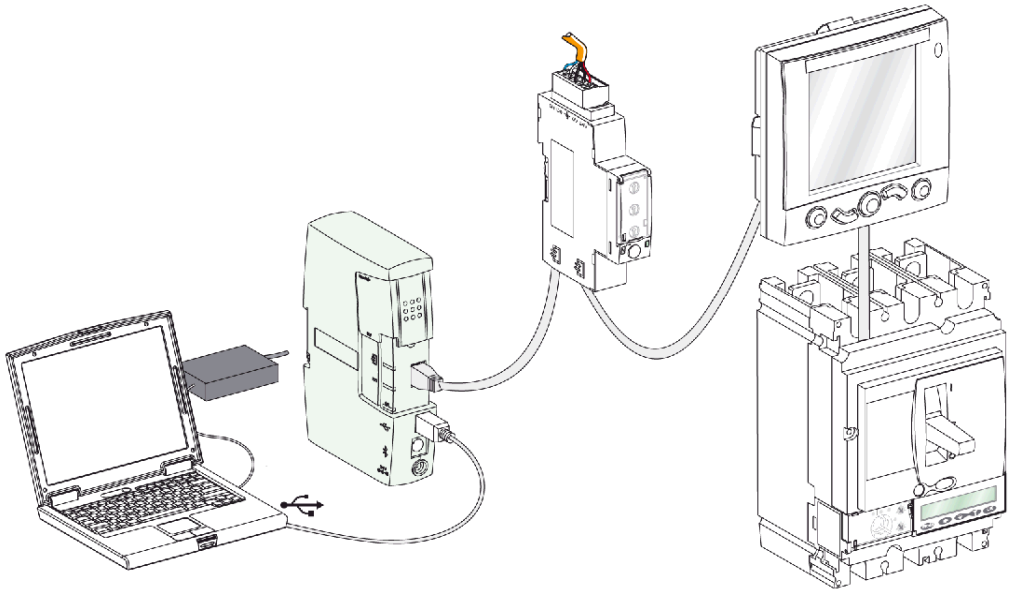
External Power Supply LED

The orange external power supply LED lights up when the maintenance module does not have enough power (in the case of USB connection on a PC running on low battery, for example). In this case, it is necessary to use the external power supply unit provided in the maintenance kit. The LED goes off when the external power supply unit is connected.



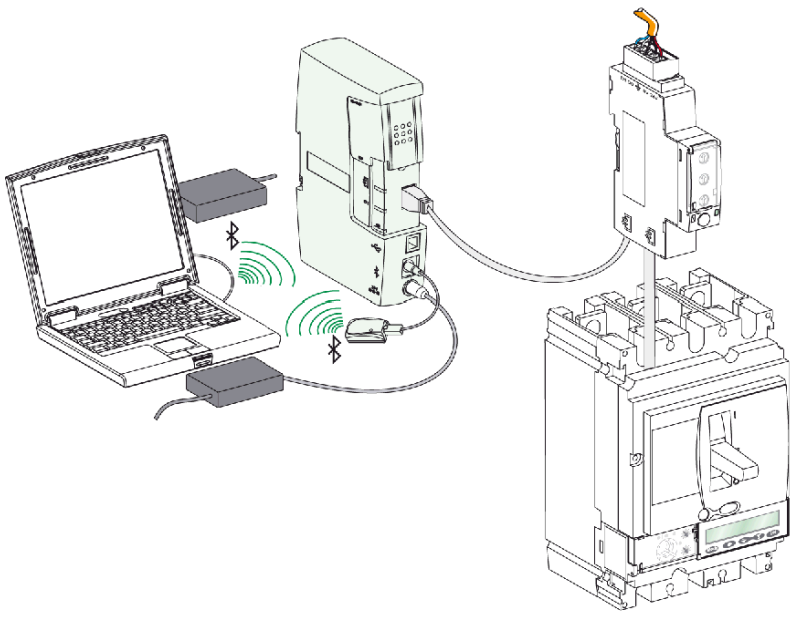
USB Connection

In the case of a USB connection, the maintenance module is powered via the USB port:



Bluetooth Connection

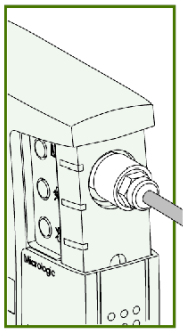
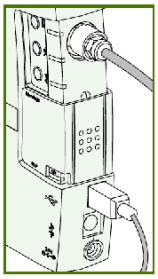
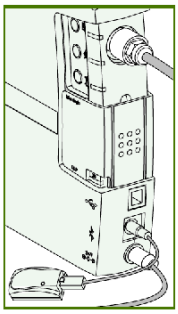
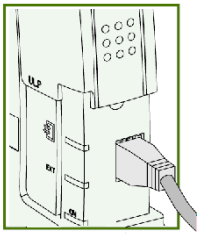
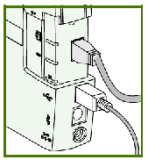
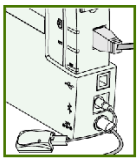
In the case of a Bluetooth connection, the maintenance module is powered by the 24 V DC external power supply unit provided in the maintenance kit.



Use - Summary

Summary of Connection and Power Supply Procedures

The table below summarizes the procedures for connecting and powering the maintenance module:

Connection to the IMU	Connection to the PC	Associated Functions
Connection to the test port on the Micrologic trip unit 	No connection to the PC	• The maintenance module is in offline mode. • The maintenance module is powered by its 24 V DC external power supply unit. • The user can test Compact NSX circuit breaker tripping, thermal memory inhibition, and ground fault protection inhibition.
	USB connection 	• The maintenance module is powered via the USB port. • The three test LEDs flash if the power supply via the USB port is inadequate. In this case, you need to use the maintenance module's 24 V DC external power supply unit. • The offline mode functions are available. • The user can test Compact NSX circuit breaker tripping and simulate alarms with LTU. • The user can check and configure the parameters of the Micrologic trip unit and the IMU ULP modules with RSU.
	Bluetooth connection 	• The maintenance module is powered by its 24 V DC external power supply unit. • The offline mode functions are available. • The user can test Compact NSX circuit breaker tripping and simulate alarms with LTU. • The user can check and configure the parameters of the Micrologic trip unit and the IMU ULP modules with RSU.
ULP connection 	USB connection 	• The maintenance module is powered via the USB port. • The external power supply LED flashes if the power supply via the USB port is inadequate. In this case, you need to use the maintenance module's 24 V DC external power supply unit. • The user can check and configure the parameters of the Micrologic trip unit and the IMU ULP modules with the RSU software.
	Bluetooth connection 	• The maintenance module is powered by its 24 V DC external power supply unit. • The user can check and configure the parameters of the Micrologic trip unit and the IMU ULP modules with the RSU software.

ULP Module Power Supplies

- If the maintenance module is connected to an IMU powered by the switchboard, the USB port or the 24 V DC external power supply unit (in the case of a Bluetooth connection) only power the maintenance module.
- If the maintenance module is connected to an IMU without a power supply, the maintenance module's 24 V DC external power supply unit must be used to power all of the IMU modules.
- If the maintenance module is connected to a ULP module without a power supply, in most cases the USB port will be capable of supplying power to the maintenance module and the ULP module. If it is not, use the maintenance module's 24 V DC external power supply unit.

3.4 RSU Software

Aim of this Section

This section describes the RSU software.

What's in this Section?

This section contains the following topics:

Topic	Page
Presentation of the RSU Software	122
RSU and Intelligent Modular Unit (IMU)	125

Presentation of the RSU Software

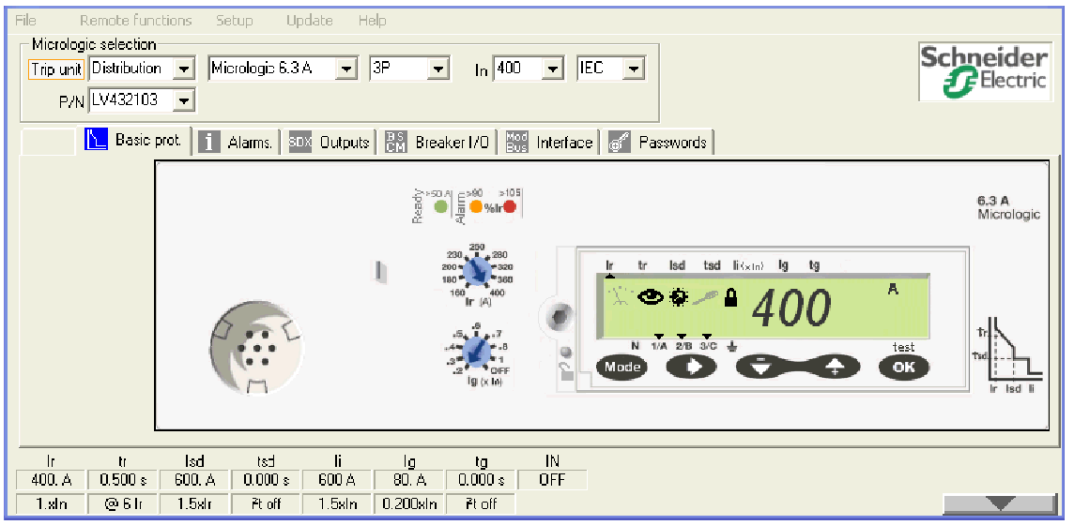
Introduction

The RSU (Remote Setting Utility) software is a Micrologic utility designed for:

- Verifying and/or configuring protection parameters
- Verifying and/or configuring metering parameters
- Verifying and/or configuring alarm parameters
- Verifying and/or configuring SDx module outputs
- Verifying and/or configuring BSCM parameters
- Verifying and/or configuring Modbus interface module communication parameters
- Modifying passwords
- Editing and saving configurations
- Displaying trip curves
- Updating the firmware in Intelligent Modular Unit (IMU) modules
- Updating front display module FDM121 languages
- Resetting passwords associated with the IMU

Description

The figure below shows the window for selecting the Micrologic trip unit using the RSU software:



The table below summarizes the functions managed by the RSU software:

Tab	Functions
Service	Metering function parameter settings
Basic prot	Micrologic trip unit parameter settings
Alarms.	Alarm parameter settings (pre-alarms and 10 user-defined alarms)
Outputs	SDx module parameter settings
BreakerI/O	BSCM module parameter settings ● Counters for OF operation overruns and actions on SD and SDE faults ● Alarm threshold associated with the OF counter ● Communicating motor mechanism: Motor mechanism counter and alarm threshold associated with the close command ● Communicating motor mechanism: Reset function parameter settings
Interface	Modbus communication interface module ● Modbus address readout ● Communication parameter settings
Passwords	Definition of password levels (4 levels)

RSU in Offline Mode

In offline mode, the RSU software does not communicate with the IMU ULP modules. For each IMU, the user can:

- Define the protection settings:
  The settings are configured on a screen that looks exactly the same as the front panel of the Micrologic trip unit. All of the options available on the Micrologic trip unit screen can be simulated using switches and by means of navigation via the keys on the keypad.
- Save and duplicate the protection settings:
  Each configuration created can be saved for use at a later date. It can be duplicated and used as the basis for programming another circuit breaker.

RSU in Online Mode

In online mode, the RSU software communicates with the IMU ULP modules. For each IMU, the user can:

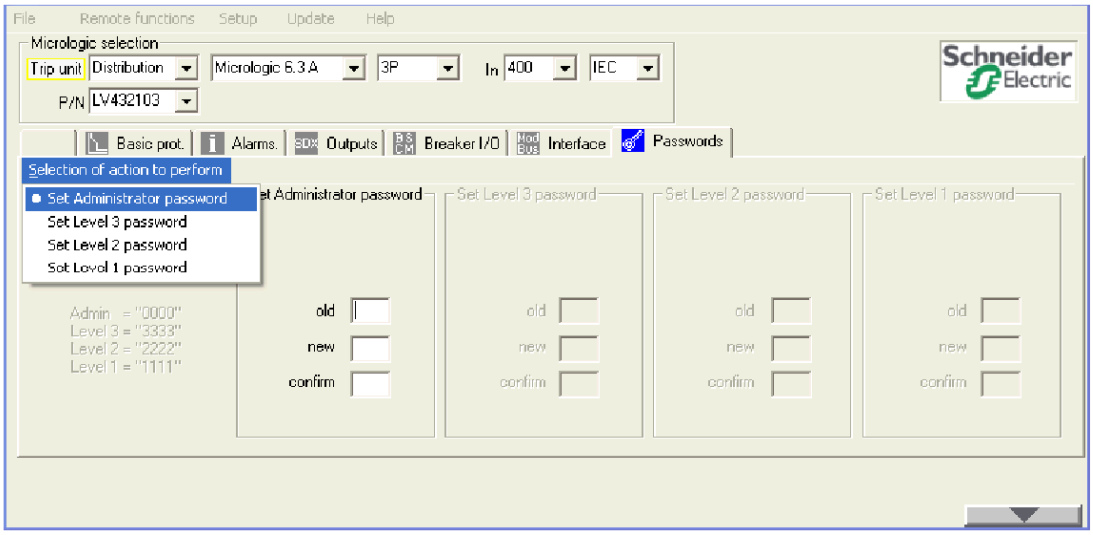
- Display the existing settings:
  RSU displays the Micrologic trip unit with access to all its settings.
- Display the corresponding protection curves:
  RSU is used to display the protection curve corresponding to the defined settings. It is possible to superimpose a second curve for a discrimination study.
- Modify the settings:
  - By setting the protection parameters online directly on the screen
  - By loading the settings prepared in offline mode
- Program alarms:
  The user can program up to 12 alarms associated with measurements or events.
  - 2 alarms are predefined and activated automatically: Overload (Ir) for the Micrologic 5 trip unit, overload (Ir) and ground fault (Ig) for the Micrologic 6 trip unit
  - 10 alarms can be chosen by the user from a list of 90, in association with thresholds, priorities, and time delays
- Update the firmware in the IMU modules:
  - Modbus communication interface module firmware update
  - Front display module FDM121 firmware update
  - Micrologic trip unit firmware update
  - Maintenance module firmware update
- Update the front display module FDM121 languages
- Reset passwords to their factory-set values

Security

There are 3 possible security levels for the settings:

- Locking of the Modbus communication interface module: When the Modbus locking pad is in the locked position, write operations are prohibited.
- Maximum limit: The position of the switches on the Micrologic trip unit defines the maximum settings that are possible using the communication option.
- Passwords: Common by default, these can be set individually for each Compact NSX circuit breaker. 4 password levels are available with RSU:
  - Levels 1, 2, and 3 are available for operators. The factory-set passwords are 1111 for level 1, 2222 for level 2, and 3333 for level 3.
  - Level 4 is reserved for the administrator. The factory-set level 4 password is 0000.

The figure below shows the window for entering passwords in RSU:



Any manual intervention on the Micrologic trip unit and on the Modbus communication interface module takes priority over settings made with RSU.

RSU and Intelligent Modular Unit (IMU)

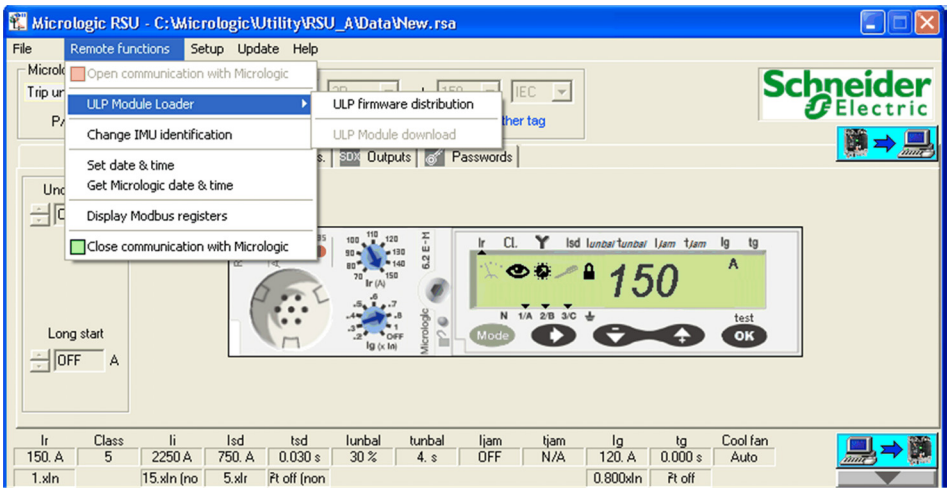
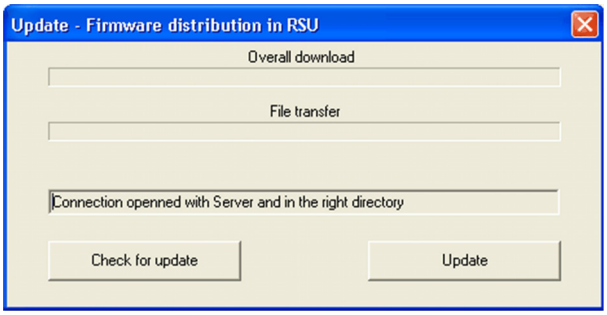
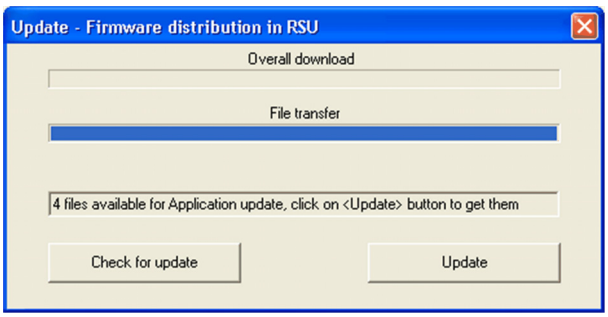
Remote Distribution of ULP Module Firmware

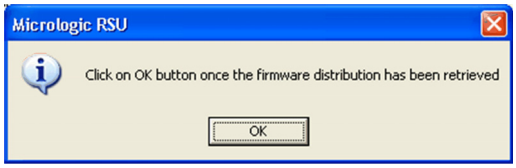
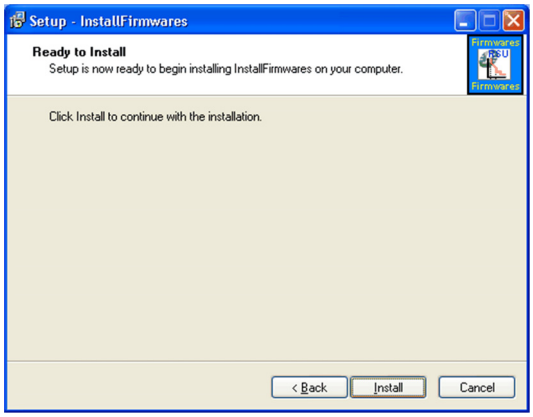
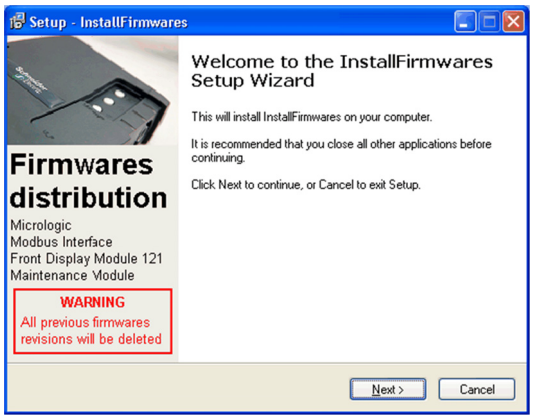
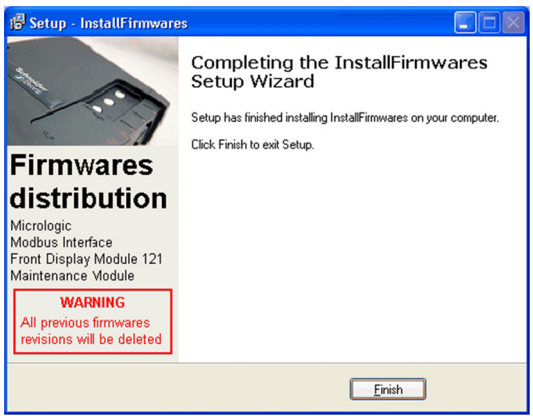
The **ULP Module Loader**/**ULP firmware distribution** function in the RSU software can be used for automatic retrieval from the Internet of:

- The latest version of the ULP module firmware
- The latest version of the front display module FDM121 language files.

NOTE: An Internet connection is needed to download the ULP module firmware.

The procedure for downloading the ULP module firmware is as follows:

Step	Action
1	Start up the RSU software.
2	In the menu bar, click on **Remote functions**, then select **ULP Module Loader > ULP firmware distribution** in the drop-down list. 
3	The connection with the update server is established.  Click on the **Check for update** button.
4	The number of available updates on the server is displayed.  Click on the **Update** button to download the updates.

Step	Action
5	 Click on the **OK** button to continue the procedure.
6	 Click on the **Install** button to continue the procedure.
7	 Click on the **Next** button to install the new firmware in the RSU directory. Previous versions of the firmware will be deleted.
8	 Click on the **Finish** button to end the installation procedure. All the new firmware is copied to the RSU software directory **C:\Micrologic\Utility\RSU_A\Firmware** with a **Readme.txt** file listing the modifications made to the firmware.

Updating All the Firmware in ULP Modules

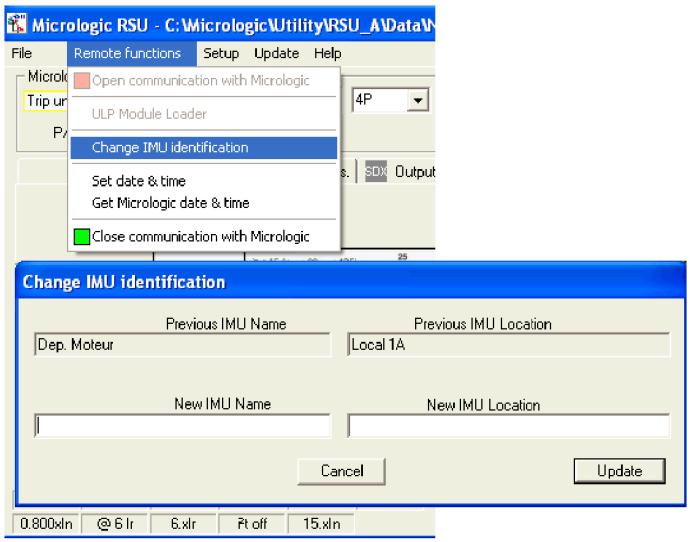
The **ULP Module Loader**/**ULP Module download** function in the RSU software is used to update all the ULP module firmware and the front display module FDM121 language files.

In order to be able to update all the ULP module firmware and the front display module FDM121 language files, you must be connected with the **Schneider Service** user profile (password = Schneider).

The connection procedure and the update procedures are detailed in the *RSU Online Help*.

IMU Name and Location

When RSU is in online mode, it can be used to assign a name and location to the IMU:



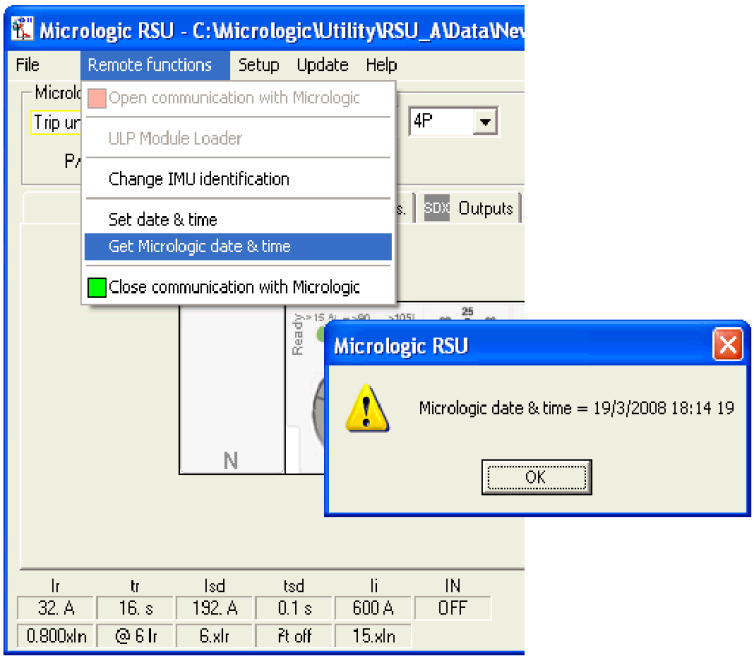
The front display module FDM121 displays the first 14 characters of the IMU name.

The front display module FDM121 does not display the IMU location. The IMU location can be viewed using RSU or the Modbus command "Read IMU name and location".

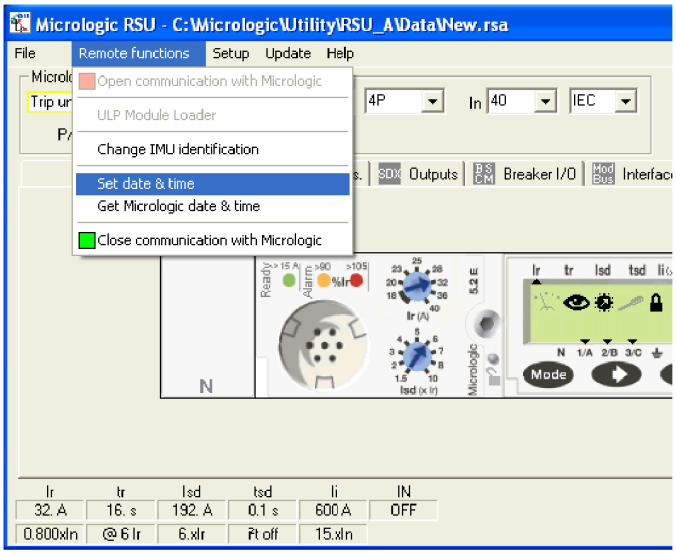
For more information about the IMU name and location, refer to the *RSU Online Help* and the *Modbus Compact NSX - User manual*.

Setting the Time on the ULP Modules

When RSU is in online mode, it can be used to read the time on the IMU ULP modules:



RSU can also be used to set the time on the IMU ULP modules. A particular reason for setting the time is if the IMU power supply fails.



For more information about the IMU ULP module get time and set time functions, refer to the *RSU Online Help* and the *Modbus Compact NSX - User manual*.

Appendices

ULP System Appendices

A

Aim of this Chapter

This chapter describes the ULP system appendices.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Technical Characteristics of ULP Modules	132
ULP Cable Characteristics	134
Modbus Cable Characteristics	135
ULP System Part Numbers	137

Technical Characteristics of ULP Modules

Environmental Characteristics

Characteristic		Value	Module			
			TRV00210	TRV00211	TRV00121	TRV00911
			Modbus interface	2-wire RS 485 isolated repeater	Front display module FDM121	Maintenance module
Conforming to standards		• IEC/EN 60947-1 • IACS E10	√	√	√	√
		• UL508 • CSA C22.2 No.14-10	√	√	√	–
Certification		• CE and C-Tick marking	√	√	√	√
		• UL • CSA	√	√	√	–
Ambient temperature	Storage	-40…+85°C	√	√	√	√
	Operation	-25…+70°C	√	√	–	–
		-10…+55°C	–	–	√	√
Relative humidity	Conforming to IEC/EN 60068-2-78	4 days, 40°C, 93% RH, energized	√	√	√	√
Protective treatment	Conforming to IEC/EN 60068-2-30	6 cycles of 24 hours, 25/55°C, 95% RH, energized	√	√	√	√
Pollution		3	√	√	√	√
Corrosive atmosphere	Conforming to IEC 60068-2-60	4 gases (H_2S, SO_2, NO_2, Cl_2)	√	√	√	√
Level of pollution	Access to hazardous parts and water penetration	Splashing outside the protective cover	IP4x	IP4x	IP53	IP4x
	Conforming to IEC/EN 60947-1 and IEC/EN 60529	Other module parts	IP3x	IP3x	–	–
		Connectors	IP2x	IP2x	IP2x	IP3x
	Conforming to IEC 62262/EN 50102 (external mechanical impacts)		IK05	IK05	IK05	IK05
Flame resistance	Conforming to IEC/EN 60947-1 and IEC/EN 60695-2-11	• 650°C 30 s/30 s on de-energized insulating parts • 960°C 30 s/30 s on de-energized insulating parts	√	√	√	√
	Conforming to UL94	V0	√	√	√	√

Mechanical Characteristics

Characteristic		Value	Module			
			TRV00210	TRV00211	TRV00121	TRV00911
			Modbus interface	2-wire RS 485 isolated repeater	Front display module FDM121	Maintenance module
Shock resistance	Conforming to NF EN 22248 (free fall, in packaging)	H = 90 cm	√	√	√	√
	Conforming to IEC 60068-2-27	15 g/11 ms 1/2 sinusoidal	√	√	√	√
Resistance to sinusoidal vibration	Conforming to IEC/EN 60068-2-6	1 g/5-150 Hz	√	√	√	√

Electrical Characteristics

Characteristic		Value	Module			
			TRV00210	TRV00211	TRV00121	TRV00911
			Modbus interface	2-wire RS 485 isolated repeater	Front display module FDM121	Maintenance module
Power supply		19.2...26.4 V DC (-20%/+ 10%)	√	√	√	√
Consumption	Typical	24 V DC at 20°C	21 mA	15 mA	21 mA	60 mA
	Maximum	19.2 V DC at 60°C	30 mA	19 mA	30 mA	–
	Maximum with Bluetooth		–	–	–	100 mA
Resistance to electromagnetic discharges	Conforming to IEC/EN 61000-4-2	• 4 kV (direct) • 8 kV (air)	√	√	√	√
Immunity to radiated electromagnetic interference	Conforming to IEC/EN 61000-4-3	10 V/m	√	√	√	√
Immunity to electrical fast transients/burst	Conforming to IEC/EN 61000-4-4	• 2 kV (power) • 8 kV (signal)	√	√	√	√
Immunity to radiated fields	Conforming to IEC/EN 61000-4-6	10 V	√	√	√	√
Immunity to surges	Conforming to IEC/EN 61000-4-5		√	√	√	√

Physical Characteristics

Characteristic		Value	Module			
			TRV00210	TRV00211	TRV00121	TRV00911
			Modbus interface	2-wire RS 485 isolated repeater	Front display module FDM121	Maintenance module
Dimensions	W x D x H	Without power supply terminal block	18 x 72 x 89 mm	18 x 72 x 89 mm	96 x 96 x 33.1 mm	112 x 164 x 42 mm
		With power supply terminal block	18 x 72 x 99 mm	18 x 72 x 99 mm	96 x 96 x 43.2 mm	–
Weight			0.090 kg	0.090 kg	0.2 kg	0.408 kg
Mounting		DIN rail	√	√	–	√
		Other	–	–	TRV00128	Magnetic
Display	Screen		–	–	128 x 128 pixels	–
	Viewing angle	Horizontal	–	–	± 30°	–
		Vertical	–	–	± 60°	–

ULP Cable Characteristics

Characteristics

The common characteristics of ULP cables are as follows:

- Shielded cable with four twisted pairs, 0.15 mm^2 cross-section, with typical impedance of 100 Ω
- Shielded male RJ45 connector at each end, cable shielding connected to the connector cover (connector conforming to standard IEC 60603-7-1)
- Color and order of internal wires conforming to standard EIA/TIA568B.2 (see *RJ45 Pin Connection, page 31*)
- Insulation voltage of the outer sheath: 300 V
- Bending radius: 50 mm

Modbus Cable Characteristics

Introduction

If a Modbus cable different from that described in this manual (part number 50965) is used, it must have the following characteristics:

- Shielded cable with 2 twisted pairs:
  - 1 communication pair for the RS485 signal, with typical impedance of 120 Ω and minimum cross-section 0.25 mm^2 The recommended colors for the wires are white and blue.
  - 1 24 V DC power supply pair. The cross-section depends on the current to be carried and the length of the Modbus cable required, with the following restrictions: 0.32 mm^2 minimum for a 24 V DC rated at 1 A, and 0.5 mm^2 minimum for a 24 V DC power supply rated at 3 A.
    The recommended colors for the wires are black and red.
- Shielding braid, with shielding drain wire (for connecting the shield to the ground terminal on the Modbus communication interface module's 5-pin connector)
- Nominal insulation voltage of the outer sheath: 300 V minimum

Connection Rules

The same rules and recommendations for connection of the Modbus cable defined in this manual should be followed when using the Modbus cables recommended below.

Part Numbers

The table below lists two recommended Modbus cable part numbers:

Type of Installation	Rating 24 V DC	Cross-Section of Power Supply Pair	Part Number	Comment
Installation limited to a few IMUs	1 A	0.34 mm^2	Belden part no. 3084A	External diameter limited to 7 mm for ease of wiring
Large installation: all topologies	3 A	0.75 mm^2	Belden part no. 7895A	Recommended cable with shielding drain wire and 9.6 mm diameter

Modbus Cable Lengths

The table below lists the maximum Modbus cable lengths for a centralized Modbus architecture (see *Centralized Modbus Architecture, page 44*) depending on the cross-section of the Modbus cable power supply pair:

24 V DC Rating	Cross-Section of Power Supply Pair	L0 (in 0.75 mm^2 Wires)	L1	Sum of the L1s (for all Power Supply Segments)	Sum of the L1s and L3s (Total Length)
1 A	0.34 mm^2	5 m	30 m	75 m	500 m
	0.5 mm^2	5 m	45 m	105 m	500 m
3 A	0.34 mm^2	Cross-section not compatible with currents > 1 A			
	0.5 mm^2	3 m	15 m	35 m	500 m
	0.75 mm^2	3 m	25 m	60 m	500 m
	1 mm^2	3 m	30 m	70 m	500 m
	1.5 mm^2	3 m	50 m	120 m	500 m

The table below lists the maximum Modbus cable lengths for a daisy-chained distributed Modbus architecture (see *Daisy-Chained Distributed Modbus Architecture, page 51*) depending on the cross-section of the Modbus cable power supply pair:

24 V DC Rating	Cross-Section of Power Supply Pair	L0 (in 0.75 mm^2 Wires)	L1	Sum of the L1s (for all Power Supply Segments)	Sum of the L1s and L3s (Total Length)
1 A	0.34 mm^2	5 m	30 m	75 m	500 m
	0.5 mm^2	5 m	45 m	105 m	500 m
3 A	0.34 mm^2	Cross-section not compatible with currents > 1 A			
	0.5 mm^2.	3 m	15 m	35 m	500 m
	0.75 mm^2	3 m	25 m	60 m	500 m
	1 mm^2	3 m	30 m	70 m	500 m
	1.5 mm^2	3 m	50 m	120 m	500 m

The table below lists the maximum Modbus cable lengths for a tap-linked distributed Modbus architecture (see *Tap-Linked Distributed Modbus Architecture, page 57*) depending on the cross-section of the Modbus cable power supply pair:

24 V DC Rating	Cross-Section of Power Supply Pair	L0 (in 0.75 mm^2 Wires)	L1	L2	Sum of the L2s (for all Tap Links)	Sum of the L1s, L2s, and L3s (Total Length)
1 A	0.34 mm^2	5 m	20 m	10 m	40 m	500 m
	0.5 mm^2	5 m	35 m	10 m	40 m	500 m
3 A	0.34 mm^2	Cross-section not compatible with currents > 1 A				
	0.5 mm^2	3 m	10 m	5 m	40 m	500 m
	0.75 mm^2	3 m	15 m	10 m	40 m	500 m
	1 mm^2	3 m	20 m	10 m	40 m	500 m
	1.5 mm^2	3 m	40 m	10 m	40 m	500 m

ULP System Part Numbers

ULP System for Compact NSX - Part Numbers

The table below lists the part numbers for the components of the ULP system for Compact NSX:

Product	Description	Part Number
Compact NSX circuit breaker	–	See *Compact NSX 100-630 A - Catalogue*
NSX cord	L = 0.35 m	LV434200
	L = 1.3 m	LV434201
	L = 3 m	LV434202
Isolated NSX cord	L = 1.3 m, U > 480 VAC (cord with female socket)	LV434204
BSCM	–	LV434205
Micrologic trip unit	–	See *Compact NSX 100-630 A - Catalogue*
Front display module FDM121	–	TRV00121
Surface-mounting accessory	–	TRV00128
Modbus communication interface module	–	TRV00210
2-wire RS 485 isolated repeater module		TRV00211
Stacking accessory	10 stacking accessories	TRV00217
Maintenance kit	Maintenance module, 24 VDC external power supply unit and associated cables	TRV00910
Maintenance module		TRV00911
Maintenance module power supply unit	–	TRV00915
Micrologic test cable	–	TRV00917
Bluetooth option	–	VW3A8114
RSU software	–	LV4ST100
LTU software	–	LV4ST121
ULP cable	L = 0.3 m (10 cables)	TRV00803
	L = 0.6 m (10 cables)	TRV00806
	L = 1 m (5 cables)	TRV00810
	L = 2 m (5 cables)	TRV00820
	L = 3 m (5 cables)	TRV00830
	L = 5 m (1 cable)	TRV00850
RJ45 female/female connector	10 RJ45 female/female connectors	TRV00870
ULP terminator	10 ULP terminators	TRV00880
Modbus terminator	2 Modbus cable terminators with impedance of 120 Ω + 1 nF	VW3A8306DRC
24 VDC power supply	24/30 VDC-24 VDC-1 A-overvoltage category IV	54440
	48/60 VDC-24 VDC-1 A-overvoltage category IV	54441
	100/125 VDC-24 VDC-1 A-overvoltage category IV	54442
	110/130 VAC-24 VDC-1 A-overvoltage category IV	54443
	200/240 VAC-24 VDC-1 A-overvoltage category IV	54444
	380/415 VAC-24 VDC-1 A-overvoltage category IV	54445
	100/500 VAC-24 VDC-3 A-overvoltage category II	ABL8RPS24030
Modbus cable	Belden: 7 mm diameter shielded cable with 2 twisted pairs	3084A
	Belden: 9.6 mm diameter (recommended) shielded cable with 2 twisted pairs	7895A
	Cable with 2 twisted pairs without shielding drain wire	50965

Product	Description	Part Number
Shunt terminal block	4-channel spring terminal block (gray)	AB1 RRNETV235U4
	4-channel protective ground terminal block (green/yellow)	AB1 RRNETP235U4
	End cover	AB1 RRNACE244
	Snap-in plastic end stop	AB1 AB8R35
	Phoenix Contact: Pluggable connector MSTB 2.5/5-STF-5.08	1778014
	Phoenix Contact: Base unit on DIN rail UMSTBVK 2.5/5-GF-5.08	1787953
	Phoenix Contact: Optional cable cover for pluggable connector KGG-MSTB 2.5/5	1803895
Ethernet gateway	MPS100	33507
	EGX100	EGX100MG
	EGX300	EGX300

TRV99101

ULP (Universal Logic Plug) - User manual

Compact NSX

TRV99101 France

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As standards, specifications and designs change from time to time, please ask for confirmation of the information given in this publication.

Printed on recycled paper.

Production: Assystem France
Publication: Schneider Electric
Printed: